Oak Grove Village Well Site
Operable Unit 1
Record of Decision for Interim Action Concurrence

Issue:

The Director must decide whether or not to concur with the Record of Decision for Interim Action (ROD) for OU1 of the Oak Grove Village Well Site.

Considerations:

1. The ROD was completed by the Missouri Department of Natural Resources' Hazardous Waste Program (HWP) for the U.S. Environmental Protection Agency (EPA).

2. The EPA has concurred with the ROD.

3. The selected remedy, Alternative V, is a remedial action alternative that was presented within the Post-Phase II Feasibility Study (FS).

4. The selected remedy is as protective of human health and the environment and is slightly less expensive than any other alternatives presented in the FS.

5. The signing of the ROD is on a tight schedule due to the EPA's expected signature date of September 28, 2007.

6. It is likely that a substantial part of the remedial action will be paid for through Superfund. A state match of 10% up to $32,792 may be necessary.

Please indicate your preference by signing the appropriate line below:

I concur with the ROD for Interim Action for OU1 for the Oak Grove Village Well Site as submitted to the DNR/HWP for the EPA by signing this and the letter to the Ms. Cecilia Tapia, Director of Superfund Division, Region VII.

Doyle Childers _______________ DATE: 9-26-07

Doyle Childers, Director
Missouri Department of Natural Resources

I do not concur with the ROD for OU1 for the Oak Grove Village Well Site as submitted by the DNR/HWP for the EPA at this time.

_______________ DATE: ___________

Doyle Childers, Director
Missouri Department of Natural Resources

5.0

Statutory Determinations

The selected interim remedy is protective of human health and the environment in the short term and is intended to provide adequate protection until the final ROD is signed; complies with (or waives) those federal and state requirements that are applicable or relevant and appropriate requirements (ARARs) for this limited-scope action, and is cost-effective. This action is an interim solution only, and is not intended to utilize permanent solutions and alternative treatment technologies to the maximum extent practicable for this OU. Because this action does not constitute the final remedy for OU1, the statutory preference for remedies that employ treatment that reduces, toxicity, mobility, or volume as a principle element will be addressed by the final response action. Because this remedy will result in hazardous substances remaining on-site above health-based levels that allowed for unlimited use and unrestricted exposure until the remedial action is complete, statutory reviews will be conducted every five years after commencement of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment. Because this is a ROD for interim action, review of this site and remedy will be ongoing as the EPA continues to develop remedial alternatives for OU1.

Data Certification Checklist

The following information is included in the Decision Summary Section of the ROD for Interim Action. Additional information can be found in the Administrative Record file for OU1.

- The COC and its respective concentrations (Sections 5.6 and 6.1.1).
- Baseline risk represented by the COC (Section 6.1).
- Cleanup levels established for the COC and the basis for this level (Section 7.1).
- How the source materials constituting principal threats are addressed (Section 12.0).
- Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater used in the baseline risk assessment and the ROD (Section 5.5).
- Potential land and groundwater use that will be available at OU1 as a result of the selected remedy (Section 5.5).
- Estimated capital, annual operation and maintenance (O&M), and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected (Sections 10.7 and 13.3).
- Key factors that led to selecting the remedy (Sections 10.0 and 11.0).

Authorization Signatures

9-26-07

Doyle Childers, Director
Missouri Department of Natural Resources

Date

for
9-28-07

Cecilia Tapia, Director
Superfund Division
U. S. Environmental Protection Agency

Date

RECORD OF DECISION FOR INTERIM ACTION FOR OPERABLE UNIT 1

Oak Grove Village Well Superfund Site
Franklin County, Missouri

September 28, 2007

PREPARED BY

Missouri Department of Natural Resources
Division of Environmental Quality
Hazardous Waste Program

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Declaration of the Record of Decision for Interim Action Oak Grove Village Well Site, Operable Unit 1 (OU1) Oak Grove Village, Missouri

Site Name and Location

The Oak Grove Village Well site (site), Operable Unit 1 (OU1) is located in Oak Grove Village (OGV), Franklin County, Missouri. OGV is located approximately 70 miles southwest of St. Louis in eastern Missouri, just off Interstate 44 (I-44). OGV is adjacent to and northeast of the city of Sullivan (COS) and both communities are southwest of the city of Stanton along I-44. The Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) identification number for the site is MOD981717036. After Phase II of the Remedial Investigation (RI) was completed, the Missouri Department of Natural Resources (DNR) and the U.S. Environmental Protection Agency (EPA) decided to divide the site into two operable units to complete additional site work. This Record of Decision (ROD) for Interim Action addresses Operable Unit 1 (OU1).

Statement of Basis and Purpose

This decision document presents the selected remedy for interim action for OU1 in Oak Grove Village, Missouri. The interim remedial action was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record for OU1.

The EPA, as the support agency, concurs with the selected remedy.

Assessment of the Site

The remedial action selected in this ROD for Interim Action is necessary to protect the public health or welfare and the environment from actual or threatened releases of hazardous substances into the environment.

Description of the Selected Remedy

This ROD for Interim Action addresses contamination in OU1. The contaminants of potential concern (COPCs) for OU1 are chlorinated volatile organic compounds (VOCs) contamination in groundwater. The source materials for the VOCs in OU1 are currently unknown despite substantial investigative efforts. The only VOC, which was identified as a contaminant of concern (COC), is trichloroethlyene (TCE). A final remedy for OU1 will be determined after the implementation of this interim action.

The selected interim remedy will use treatment to address the TCE contamination in OU1 that is being supplied to groundwater users. The major components of the selected interim remedy include:

- Providing an alternate water supply via public water distribution system to homes with residential wells and businesses with commercial/industrial wells that have TCE contamination in groundwater that exceeds the cleanup level and are within the feasible limits of a public distribution system.

- Provide wellhead treatment using individual treatment systems for residential and commercial/industrial wells found outside the feasible limits of extending water lines to a public water distribution system.

- Conducting an extensive well survey within OU1 to update the current well inventory.

- Conducting groundwater sampling of select wells, which include those wells with individual treatment systems, Oak Grove Village Well #2 (OGV02), residential and commercial/industrial wells with site contamination and potential site contamination in groundwater, COS wells, and site monitoring wells. Groundwater monitoring is intended to detect contamination in any well that may exceed the cleanup level.

- Monitor OGV02 to ensure that the air stripper provides a clean water supply to OGV, while remediating the groundwater in the cone-of-capture of OGV02.

- OGV01 will be properly plugged and abandoned to prohibit exposure to contamination in groundwater.

- Implement informational ICs, including the development and distribution of educational materials to raise future awareness of the site contamination. Signs would be placed on wells that are replaced by a private wellhead treatment system indicating the appropriate uses of the well. The need for any additional ICs will be evaluated over the course of this interim action. If additional ICs are necessary, they will be implemented as part of the final remedy.

- Five-Year Reviews of the OGV site will be conducted since contamination in groundwater will remain at the site.

The selected remedial action, if properly implemented and properly maintained, will achieve substantial risk reduction by removing the exposure pathways to residential homes and commercial properties that could be impacted by site related contamination in groundwater. In addition, it will ensure that new exposure pathways to OU1 wells are addressed if additional wells are contaminated through plume migration. Groundwater sampling will also determine when the secondary Remedial Action Objective (RAO) of remediating the contamination in groundwater is achieved.

Statutory Determinations

The selected interim remedy is protective of human health and the environment in the short term and is intended to provide adequate protection until the final ROD is signed; complies with (or waives) those federal and state requirements that are applicable or relevant and appropriate requirements (ARARs) for this limited-scope action, and is cost-effective. This action is an interim solution only, and is not intended to utilize permanent solutions and alternative treatment technologies to the maximum extent practicable for this OU. Because this action does not constitute the final remedy for OU1, the statutory preference for remedies that employ treatment that reduces, toxicity, mobility, or volume as a principle element will be addressed by the final response action. Because this remedy will result in hazardous substances remaining on-site above health-based levels that allowed for unlimited use and unrestricted exposure until the remedial action is complete, statutory reviews will be conducted every five years after commencement of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment. Because this is a ROD for interim action, review of this site and remedy will be ongoing as the EPA continues to develop remedial alternatives for OU1.

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- Key factors that led to selecting the remedy (Sections 10.0 and 11.0).

Authorization Signatures

Doyle Childers, Director | Date
Missouri Department of Natural Resources

Cecilia Tapia, Director | Date
Superfund Division
U. S. Environmental Protection Agency

Decision Summary of the Record of Decision for Interim Action Oak Grove Village Well Site, Operable Unit 1 (OU1) Oak Grove Village, Missouri

1.0 Site Name, Location, and Description

This Interim Record of Decision (ROD) was developed by the Missouri Department of Natural Resources (DNR), as the lead agency, to select an interim remedial action alternative for the Oak Grove Village Well site (OGV site), Operable Unit 1 (OU1) in Oak Grove Village (OGV), Missouri. The U.S. Environmental Protection Agency (EPA) is the support agency. The CERCLIS identification number for the site is MOD981717036.

Oak Grove Village (OGV) is a small rural community, with a population of 382 (2000 Census), located in Franklin County, Missouri (Figure 1). The OGV municipal well #1 (OGV01) was drilled in 1964 and was the only source of drinking water for the village residents for a number of years. The DNR Public Drinking Water Program detected trichloroethylene (TCE) contamination in OGV01 on June 10, 1986, at 6 micrograms per liter (µg/l) [or parts per billion (ppb)] during routine water sampling. The EPA and the Missouri Maximum Contaminant Levels (MCL), and the Missouri Water Quality Standard (MWQS) for TCE are 5 µg/l.

In December 2002, a new municipal well #2 (OGV02) was drilled; however, contamination prevented its use until an air stripper was installed and deemed operational. OGV02, with its air stripper in place, began operation and replaced OGV01 as the source of drinking water for OGV in April 2005.

The location and amount of contamination at the OGV site varies due to contaminant plume movement, which is influenced by well pumping and karst geology. Due to the spatial distribution of the contamination and the number of wells with contamination in groundwater, the site developed into a regional investigation centered on the OGV wells. The site is defined as regional contaminant plumes in groundwater that has contaminated the OGV wells and the surrounding area. Since the contamination is widespread, it has impacted private (residential and commercial/industrial) and municipal wells in OGV, Sullivan, Stanton, and the unincorporated areas in the vicinity of these municipalities, as well as a spring in OGV. The OGV site includes contamination in groundwater, surface water and cave air.

At the conclusion of the comment period for the Phase II Proposed Plan, the EPA and DNR decided additional site work was needed to fill in the remaining data gaps and to adequately define the OGV site. In order to fill in the data gaps, the site was divided into two OUs:

- Operable Unit 1 (OU1) consists of the OGV wells, the Highway AF wells, and the area west and south of the OGV wells.
- Operable Unit 2 (OU2) consists of the closed Sullivan Landfill and/or other unknown potential source areas, wells and springs around the closed Sullivan Landfill, the Meramec River, and the La Jolla Spring cave complex (Table 1-1, Figure 1).

The only sources found to be impacting the Ozark Aquifer are the former TRW/Ramsey Facility and the closed Sullivan Landfill. These two TCE source areas are not included in OU1 because the former TRW/Ramsey facility is currently working with DNR Resource Conservation Recovery Act (RCRA) Corrective Action to address the TCE contamination originating from its property and the closed Sullivan Landfill is being investigated under OU2. Therefore, at this time, it appears the remedial action for OU1 will be conducted by the EPA using federal funds, and the state will be required to pay a 10% remedial action cost share, and will be responsible for 100% of operation and maintenance (O&M).

2.0 Site History and Enforcement Activities

OGV01 was drilled in 1964 and was, for a number of years, the only drinking water source for the village residents. Contamination at the OGV site was first identified on June 10, 1986, by the DNR's Public Drinking Water Program. TCE, a suspected human carcinogen, was detected at 6 micrograms per liter (µg/L) in OGV01 during routine water sampling. The EPA primary drinking water Maximum Contaminant Level (MCL), the Missouri public water MCL, and the Missouri Water Quality Standard (MWQS) for TCE are 5 µg/L or ppb as set by the federal Safe Drinking Water Act and regulations; the Missouri Revised Statutes, Chapter 640 and the Missouri Public Drinking Water regulations (Title 10 Code of State Regulations Division 60), and the Missouri Clean Water Law and regulations (10 CSR 20-7).

Since initial detection, the TCE concentrations detected in OGV01 have ranged from 1.5 (November 15, 2000) to 99.6 µg/l (April 29, 2004). Investigations were conducted to determine the location and extent of the contaminant plumes in groundwater impacting area wells. The sample results from area wells determined that TCE and other chemicals of potential concern (COPCs), such as tetrachloroethylene (PCE) and the degradation products of TCE, had contaminated private (residential and commercial/industrial), and municipal wells, as well as a spring in the OGV area.

In December 1990, the DNR issued OGV a Notice of Violation (NOV) for drinking water violations. OGV took OGV01 out of service in July 1991, and began buying water from Sullivan. In September 1992, OGV reopened OGV01. The DNR resumed sampling OGV01; however, TCE in OGV01 remained above the MCL. In January 1994, the DNR issued a second Notice of Order to Abate Violations. In response to the 1994 notice, OGV took OGV01 out of operation and started purchasing water from Sullivan.

The DNR completed a Preliminary Assessment in June 1987. It recommended additional sampling and a hydrogeologic assessment. It also identified the closed Sullivan Landfill located northeast of OGV, the TRW Automotive Product Inc. – Ramsey Division Facility, and two properties at the current Sullivan Wal-Mart location – the Sohn property and the Blanton property -- as potential TCE sources.

The DNR completed a Hydrogeologic Assessment in December 1987. It stated the recharge area for OGV01 was to the southwest, toward the center of Sullivan; however, major faults, a field of operating municipal wells and karst topography made it difficult to determine local groundwater flow direction.

The DNR completed a Site Investigation in October 1988. It revealed TCE was in OGV01, the OGV distribution system, in Sullivan municipal well #02 (COS02), and the Voss Well (a private well east of the closed Sullivan Landfill); however, the sampling did not attribute the contamination to a specific source or Potentially Responsible Parties (PRPs).

The EPA completed an Expanded Site Investigation in September 1994 and the DNR completed an Additional Site Assessment in 1998. No potential source areas were identified during these investigations, and it was recommended that a CERCLA remedial investigation/feasibility study (RI/FS) be conducted.

The DNR RI/FS was conducted in a phased approach to determine the nature and extent of the contamination detected in OGV01, to identify possible sources of the contamination in groundwater, and to identify PRPs. The Phase I RI began in October 1999. The Phase I RI evaluated existing data, collected additional data to narrow data gaps, determined the existence and location of contamination, and identified additional potential source areas. Area-wide sampling of private, commercial, and municipal wells, as well as springs and creeks, detected TCE and other VOCs in multiple wells and one spring. The information obtained during the Phase I RI provided additional data to better define the extent of the area-wide contamination.

On September 13, 2001, during the Phase I RI, the EPA, with state concurrence, proposed the OGV site for the National Priority List (NPL). On September 5, 2002, the NPL listing became final.

The Phase II RI began in April 2002, and it was completed in August 2005. The Phase II RI activities consisted of continued sampling of private, commercial, and municipal wells, as well as area springs. Additional field activities included: (1) investigating and sampling the OGV and Sullivan sanitary sewers, (2) installing and sampling groundwater monitoring wells, and (3) sampling possible additional source areas.

The data collected during the Phase II RI narrowed the data gaps and better defined the location and extent of the contaminant plumes. A FS and Proposed Plan were completed based on the conclusions of the Phase II RI. However, upon review the EPA and DNR decided additional site work was needed to fill in the remaining data gaps and to adequately define the OGV site. In order to fill in the data gaps, the OGV site was divided into two OUs:

- Operable Unit 1 (OU1) consists of the OGV wells, the Highway AF wells, and the area west and south of the OGV wells.
- Operable Unit 2 (OU2) consists of the closed Sullivan Landfill and/or other unknown potential source areas, wells and springs around the closed Sullivan Landfill, the Meramec River, and the La Jolla Spring cave complex (Figure 1).

The Post-Phase II RI investigation (2005 to June 2007), which was a continuation of the Phase II RI investigation, included source area investigations and the additional characterization, installation, and/or completion of private, municipal, and monitoring wells. The additional field activities included: (1) sampling Winsel Creek and the Meramec River, (2) characterizing OGV01, (3) sampling OGV01 and OGV02, (4) installing and sampling additional groundwater monitoring wells, (5) sampling previously known potential source areas, and (6) sampling possible additional source areas. The following additional information was obtained from the Post-Phase II RI and is relevant to OU1:

- The investigations of OGV01 indicated that most of regional contamination in the aquifer is not directly intersected by OGV01. The pumping conditions create a cone-of-capture, which influences the localized groundwater gradients. Although OGV02 is in close proximity to OGV01, the differences in contaminant concentrations in the two wells may be attributed to the interval at which contamination is entering OGV02, the interval size (thickness), the pumping rate needed to impact the volume of contamination entering the OGV02 borehole, and its proximity to the contaminant plumes.

- The VOC contamination along Highway AF and East-West Road supports the idea that an unknown localized source or a shallow groundwater plume is impacting the residential wells in the Highway AF area. The recent (2006) detection of other COPCs in the Highway AF wells may indicate a change in the chemistry of a localized, shallow source or the addition of another source, impacting the Highway AF wells.

- The absence of TCE and other COPCs in the White House well (WH1) is consistent with the absence of TCE in the shallow parts of monitoring well #3 (MW3), monitoring well #4 (MW4), and monitoring well #5 (MW5), and with the small TCE concentrations in the shallow (less than 450 feet deep) packered zone in OGV01. The absence of TCE in WH1 and other nearby shallow monitoring wells, and the large TCE concentrations detected at depth in OGV01, strongly suggests that the source of TCE in OGV01 and OGV02 are not from a local source.

- After the completion of the deep monitoring wells and the installation of the shallow monitoring wells, the contaminated groundwater impacting the OGV wells was better defined. Sampling of MW-3, MW-4 and MW-5 revealed no TCE or other COPCs in the deep (580 feet) well (MW-3) and the two shallow (225 and 240 feet) wells (MW-4 and MW-5). Based on these results, the shallow (less than 250 feet deep) groundwater west, southwest, and south of the OGV wells and the deep (less than 580 feet deep) groundwater directly south of the OGV wells are not contributing to the groundwater contamination in the OGV wells.

- As part of the Post-Phase II RI, calculations were done to estimate the amount of TCE needed to contaminate the groundwater in the OGV wells. Based on the results, 12.5 gallons of pure TCE product was needed to contaminate the extracted groundwater in the OGV wells.

Other Investigations

Other groundwater investigations in the OGV/Sullivan area took place during the same timeframe as the investigations conducted through Superfund. The former TRW/Ramsey facility and Wal-Mart performed independent investigations in certain areas of the OU1 site.

In 1989, the EPA initiated a RCRA Facility Assessment (RFA) for the former TRW/Ramsey facility. In 1990, TRW, also under RCRA authority, initiated groundwater investigations in relationship to its former facility. Based on the findings of the RFA, the DNR and EPA entered into a RCRA 3008(h) Corrective Action Administrative Order on Consent (AOC) with TRW and the current property owners in April 1993. The AOC directed TRW to conduct an investigation and evaluate corrective measures to cleanup contaminant releases.

Between 1993 and 1998, TRW performed corrective action activities in accordance with the AOC at the former TRW/Ramsey facility. As part of the RCRA Facility Investigation (RFI), TRW installed a monitoring network of 41 wells. The RFI detected a TCE plume in groundwater beneath the facility and detected TCE in residential wells and in three Sullivan municipal wells.

In 1991 and 1992, Phase I and Phase II Environmental Site Assessments were conducted southwest of the OGV wells by the Wal-Mart company in anticipation of a property purchase. The three areas of TCE contamination detected were designated: the Highway 185 Garage (Sohn property), the Blanton property, and a machine shop. Wal-Mart purchased all of the property within the study area, except the Sohn property. The purchased property was then covered with a Wal-Mart store building and a paved parking lot. Additional investigations were conducted on these properties from 2004 through 2006.

3.0 Community Participation

Throughout the OGV site's investigation various community involvement activities included the distribution of fact sheets, multiple meetings with the public, and the establishment of an Information Repository at the OGV City Hall and the Sullivan Public Library.

On August 1, 2007, the DNR issued the Interim Proposed Plan for OU1. A 30-day public comment period was held from August 1 through August 30, 2007. On August 3, 2007, the EPA sent a fact sheet to the public listed on the site's mailing list. The fact sheet summarized the OGV site background, the Superfund remedial process, the remedial action alternatives evaluated in the Interim Proposed Plan and the preferred interim remedial action to members of the community and other interested persons identified on the site's mailing list.

Notices regarding the public meeting to present the Proposed Plan were published in the *Sullivan Independent News* newspaper on August 1, August 8, and August 15, 2007. The public meeting was held on August 15, 2007, in Oak Grove Village. At the meeting, representatives from the DNR, the DHSS, and the EPA answered questions about the conclusions of the RI/FS and Post-RI/FS, the remedial action alternatives, and the Proposed Plan for Interim Action. The DNR's response to comment received at the public meeting, as well as written comments received during the comment period, are included in the Responsiveness Summary (Section III), which is part of this ROD.

4.0 Scope and Role of Response Action

As with many Superfund sites, the groundwater conditions at the OGV site are complex. With the completion of the Phase II RI/FS, the DNR and EPA decided to organize the additional work for the Post-Phase II RI at the OGV site into two OUs.

The ROD for Interim Action for OU1 provides actions that will be taken in response to the contamination of the groundwater aquifer in the area depicted in Figure 1. Ingestion of water extracted from this aquifer poses a potential current and future risk to human health because potentially the acceptable risk range can be exceeded and concentrations of contaminants could become greater than the MCL for drinking water (as specified in the Safe Drinking Water Act).

Therefore, the DNR is pursuing this interim remedial action for OU1 at this time. The recommended interim actions will achieve risk reduction by removing the exposure pathways to residential homes and commercial properties that are impacted by the contamination in the groundwater. Groundwater monitoring and informational institutional controls (ICs), such as educational materials, will ensure that new exposure pathways to area drinking water wells are not created through plume migration or through the construction of new wells. The interim action, as outlined in this section of the ROD, will neither be inconsistent with, nor preclude, implementation of the final remedy for OU1.

5.0 Site Characteristics

5.1 Size

Site contamination is widespread and includes portions of OGV, Sullivan and Stanton. OU1 consists of the OGV wells, the Highway AF wells, and the area west and south of the OGV wells.

5.2 Topographical Information

Topographic relief is the result of gradual uplift of the Ozark dome in southern Missouri; fluvial erosion, transportation and deposition; and mass wasting of the uplifted rocks by precipitation runoff and stream flow (USDA, 1986). Widespread karst features include caves, sinkholes, and springs. The topographic relief in the OGV area is accentuated by the proximity to the Bourbeuse and Meramec Rivers. The Meramec River appears to control the base level for most waterways in this area. Land surface elevation ranges from a low of about 580 feet above sea level along the Bourbeuse and Meramec Rivers to just over 900 feet along the edge of the OGV limits.

5.3. Site Geology

The site is underlain by sedimentary dolomite and sandstone formations of Ordovician and Cambrian ages. The slightly soluble dolomites contain discontinuities such as fractures, joints, and bedding planes. Groundwater flowing through these discontinuities has resulted in karst features including springs, sinkholes, and losing streams (especially Winsel Creek) within the OGV site (Elfrink 1998).

Bedding might have a significant effect on flow if it were not for the dominance of secondary porosity at the site. Bedding impact on flow is diminished when bedding planes are 'shorted' by fractures, which connect them and allow flow across the beds instead of along them. This is particularly significant above the elevation of the discharges from this plateau at the Meramec River and adjacent springs.

A structural contour map of the Gunter/Eminence contact was developed based on local well logs. The contour map revealed that a northeast plunging syncline exists and the site municipal wells that are the lowest structurally within the syncline are the OGV wells. Since contamination in groundwater would tend to migrate to the lowest point, this would increase the likelihood of contamination in groundwater migrating towards the OGV wells from any direction, especially when the OGV wells are pumping.

The following are key findings related to the groundwater flow and occurrence in the area:

1. The Roubidoux Formation is mostly unsaturated within the site area.

2. Narrow structural lows plunging to the northeast are developed at the bases of the Potosi, Eminence, and Gasconade Dolomites, and these structural lows channel groundwater to the northeast away from Sullivan, roughly parallel to I-44.

3. Development of karst hydrogeology in eastward thickening and eastward dipping Eminence and Gasconade Dolomites allow groundwater loss from the Winsel Creek drainage basin to the Meramec River drainage basin.

5.4 Site Hydrogeology

The OGV site is located in the Ozark Plateau physiographic province and the Salem Plateau subprovince. The Salem Plateau subprovince contains two regional aquifer systems – the shallower Ozark Aquifer and the deeper St. Francois Aquifer. The St. Francois confining unit, which is the Derby-Doerun Dolomite and Davis Formation, lies between the aquifers and provides some hydraulic separation between the Ozark and the St. Francois Aquifers.

Regional groundwater flow in the Ozark Aquifer is unconfined and influenced by major topographic features. Regionally, the flow direction is parallel to the major surface-water drainages, which trend north to northeast. The groundwater flow direction within the site varies from an easterly direction (Elfrink 1998) to a northeast direction (Hoffman 1987). However, as pointed out by Elfrink (1998), lateral groundwater flow direction in the Ozark Aquifer is more complicated in the OGV/Sullivan area because of karst and structural features in the host rock and because of municipal groundwater use in the area.

OGV and Sullivan are in the Bourbeuse River surface water drainage basin (Collins 1988) and normally shallow groundwater would be expected to move northward toward the discharge areas along the Bourbeuse River (Elfrink 1998). However, groundwater trace tests in OGV and Sullivan indicate that the surface water divide does not correspond to the groundwater divide in the Ozark Aquifer. Based on groundwater dye trace tests reported by Duley (1992), the dip of the structural features allows the Meramec River to "pirate" some groundwater that would otherwise be expected to discharge to the Bourbeuse River basin. The dip of the structural features, along with dye traces into Winsel Creek, shows that the area-wide groundwater is connected to the La Jolla Spring Cave Complex.

The nearby Sullivan municipal wells are also relevant to understanding OGV site conditions. All but one of the COS municipal wells is completed to draw groundwater from the Potosi Dolomite of the Ozark Aquifer. The one exception is Sullivan municipal well #10 (COS10) located approximately 3,000-feet southeast of the OGV wells, with a surface elevation of 960 feet. COS10 is open to the Ozark Aquifer (610 feet) and the St. Francois Aquifer. This well was drilled through the St. Francois confining unit (150 feet) and into the underlying St. Francois Aquifer (50 feet).

These localized site conditions, such as conduit flow in karst terrain and the location of the groundwater divide, as well as gradient reversal caused by pumping from site wells, could cause deviation from the regional north to northeast groundwater flow direction, especially in the intermediate and deep zones of the Ozark Aquifer.

5.5 Significance of Karst Geology

The effects of the karst geology on the OGV site and the water resources are pronounced. The geology forms the framework for the transport and storage of water associated with the OGV site. The dolomite and limestone formations have been greatly affected by weathering of the bedrock, both at the land surface and in the subsurface. Except for the upland areas, the soils are typically thin. In the upland area, which consists of most of the OGV site, thick deposits of unconsolidated residual materials that formed from decomposed bedrock overlie the bedrock. The residuum is typically permeable, which allows for high rates of groundwater recharge (Miller and Vandike, 1997).

Solution weathering of the bedrock has created well-integrated subsurface drainage systems that capture surface water and channel it underground. Much of the water that would ordinarily run off into streams is channeled underground through losing streams and sinkholes. The springs are recharged from sinkholes, losing streams, and general infiltration through the permeable residuum that covers most of the area. The groundwater is then slowly released from storage by the aquifer through springs and general groundwater flow, so even during dry weather, the streams maintain a well-sustained base flow (Miller and Vandike, 1997).

Wells located in OGV and Sullivan tap into the same stored groundwater, impacting local recharge. Any contamination discharged to surface soils and/or water enters the well-integrated subsurface drainage systems, allowing the contamination to impact and spread throughout the groundwater.

5.6 Characteristics of TCE

TCE is the most prevalent and widespread contaminant in groundwater and is the primary contributor to risk in OU1. TCE was detected in the groundwater in shallow and deep wells. TCE is a non-flammable, clear, colorless liquid at room temperature that is used mainly as a degreasing solvent in metalworking industries. TCE has a moderate solubility in water (1.1 g/L) and a vapor pressure of 77-mm Hg. The dominant fate of TCE released into surface water is volatilization to the air. When TCE is released to surface water, bio-concentration and biodegradation are thought to be insignificant. However, due to its moderate solubility, TCE can remain for longer periods of time in soil and groundwater where biodegradation is thought to be significantly slower than in surface water.

5.7 Conceptual Site Model

The Conceptual Site Model (CSM) for OU1 (Figure 2) provides information on the waste sources, pathways, and receptors at the OGV site and is used to develop a conceptual understanding of the OGV site to evaluate potential risks to human health and the environment.

For exposure to occur, there must be a contamination source in a medium (contamination in water, soil, or air), a receptor (a person or biota), and a mechanism or pathway for the contaminants to reach the receptor (ingestion, dermal contact, or inhalation of particles or vapors from the contaminated media).

Currently, individuals using groundwater for potable and nonpotable purposes in the OU1 area could be exposed to low-level VOCs; however, the operation of the air stripper on OGV02 and the installation of whole house treatment systems on contaminated private wells have removed exposures that exceeded safe drinking water standards. In the future, however, residents and workers could potentially be exposed to contaminants in groundwater that could be a health concern if these or other control measures are not maintained. Residents and workers could be exposed through ingestion of contaminated groundwater, dermal contact with contaminated groundwater, or inhalation of volatile chemicals emitted from contaminated groundwater.

5.8 Current and Potential Future Land and Resource Use

The land use in OGV and Sullivan is residential, commercial, and light industrial. OGV and Sullivan contain a mixture of low to high-density single-family residences, a scattering of multi-family residences, and several churches. Small businesses and light industrial manufacturing facilities are located within the combined city limits mostly along I-44 on the outer roads and near the new Sullivan Airport. These small businesses and light industrial facilities employ several hundred people, many living outside the city limits.

Since Oak Grove Village and Sullivan are near St. Louis, development is expected to continue into the future at the same rate or faster within and outside the communities and the unincorporated areas. Each community provides drinking water to its residents through its municipal wells. As development continues within Oak Grove Village and Sullivan, the new residences and new or expanded businesses and light industry will need to be added to the current municipal water supplies. This additional growth will ultimately stretch the current municipal water supplies, forcing the municipalities to expand the current water distribution systems.

However, most new home construction is located outside the area served by municipal wells in the unincorporated areas. These homes sit on larger, usually wooded residential properties with their own private wells, which draw water from the Ozark Aquifer. For new development in the unincorporated areas, new individual wells will need to be drilled to supply needed water.

Several natural resources are located in the area, including deciduous forest and agriculture. The forests, glades, and waterways, within and around the OGV site, support a rich variety of fauna such as white-tailed deer and coyote. The area also supports some threatened and endangered bats. Habitat diversity (glades, sinkholes, and caves) contributes to rich herpetofauna, fish species, and some threatened and endangered species of crustaceans and mollusks.

Land uses include tourism, hunting and fishing, boating and canoeing, forestry, grazing and row crops (corn and soybeans). Meramec Caverns, Meramec State Park, and the Meramec River are a few of the tourist attractions in the area.

6.0 Summary of Site Risks

This section focuses on the risks addressed by the interim action and provides the rational for the limited scope of the action. The rational can be supported by facts that indicate that temporary action is necessary to stabilize OU1 or a portion of OU1, prevent further environmental degradation, or achieve significant risk reduction quickly while a final remedial solution is being developed for OU1.

Two risk assessment documents were prepared for the OGV site, one for the human health risk assessment and one for the ecological risk assessment. The Missouri Department of Health and Senior Services (DHSS) prepared the *Baseline Human Health Risk Assessment (HHRA) for the Oak Grove Village Well site* dated June 2005. The Environmental Protection Agency (EPA) Region VII prepared the *Screening Level Ecological Risk Assessment (SLERA), Oak Grove Village Well site, and La Jolla Spring Cave Complex*, dated December 2004.

The HHRA estimates the human health risks if no action is taken at the site and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. For OU1, DNR's decision to take action is based primarily on the presence of TCE contamination in groundwater at levels that exceed drinking water standards. Current and future residents and commercial/industrial workers, who may be exposed through ingestion, dermal contact and/or inhalation, could be affected by the contaminated groundwater. Based on the Ecological Risk Assessment conducted, no ecological risks were identified for OU1.

6.1 Summary of Human Health Risk Assessment

This section presents a summary of the HHRA, including the identification of the contaminants of concern (COCs), the exposure assessment, the toxicity assessment, the risk characterization and the uncertainty analysis.

Complete risk assessment information can be found in the "Baseline Human Health Risk Assessment for the Oak Grove Village Well site," June 2005, prepared by the Missouri Department of Health and Senior Services.

6.1.1 Identification of Contaminants of Concern

The HHRA, as prepared by DHSS, for the OGV site was incorporated into and applied to OU1 with the assistance of DHSS. The HHRA listed the contaminants of potential concern (COPCs) and the COCs for contamination in groundwater for the OGV site.

The COPCs are those contaminants that have been detected in analytical results at the OGV site and are evaluated for risk. The COCs are those contaminants from the list of COPCs that are determined to pose a significant risk at the OGV site. Although the COPCs do not have a significant risk associated with them at the OGV site, they have proven useful as tracers to help identify the sources of contamination.

The COPCs for groundwater were developed for the risk assessment based on detectable levels of VOCs found in OGV site wells, including OGV01 and OGV02, the COS wells, and residential and commercial/industrial wells. The groundwater list for the OU1 area contains fifteen VOCs, such as solvents like TCE, PCE, degradation products, freons, pesticides, and petroleum additives. The list of COPCs for OU1 is found on Table 6-1.

Based on results of the HHRA, a smaller group of COCs were found to actually pose unacceptable human health risks at the OGV site. This smaller group acts as drivers, forcing the need for a remedial action to reduce OGV site risks. These contaminants individually contribute to an increased cancer risk greater than 1 in 10,000 or a non-cancer hazard quotient of greater than 1. The DHSS modified the list of COCs based on additional information obtained after the Phase II work and the division of the OGV site into two OUs. The modified COC list for groundwater included only TCE (highlighted on Table 6-1), that was detected in groundwater at levels that ranged from ND to 119 ug/l.

Data, from groundwater samples collected from OGV site-related residential, commercial/industrial, and municipal wells between January 2000 and May 2004 (primarily from the Phase I and II Remedial Investigations), were used to evaluate the groundwater risk. The wells were divided into "plumes" based on geographical location and referred to in the HHRA as the Highway AF Plume and the TRW Plume. In addition to these two plumes, the Sullivan municipal wells (COS09 and COS10) were evaluated separately making a total of three different areas in which risk was evaluated for OU1.

A set of exposure point concentrations for each COPC was determined for COS09, COS10, and for each plume (Table 6-2). The exposure point concentrations were established in each plume by taking the average concentration from the well with the highest concentration for each particular COPC.

6.1.2 Exposure Assessment

Exposure to contaminants is defined as the contact of a receptor with a contaminant. For exposure to occur, there must be a source of the contaminant (groundwater), a receptor (person), and a mechanism or pathway for contaminants to reach the receptor (such as ingestion, dermal contact, or inhalation).

Exposure to contaminated groundwater was evaluated for current and future residential and commercial/industrial worker scenarios. However, based on existing conditions at the OGV site, current exposures are not known to be occurring in the OU1 area above drinking water MCLs. Therefore, the HHRA only estimated lifetime excess carcinogenic risks and evaluated the potential for non-carcinogenic health effects from potential future exposure to impacted groundwater for the OU1 area.

For potential future exposures, the HHRA assumed unrestricted use of impacted groundwater and developed a reasonable maximum exposure (RME) scenario for each receptor population. Risks for potential future use of impacted groundwater were then evaluated for the residential and commercial/industrial worker scenarios using standard pathways and intake rates. Completed exposure pathways include ingestion of drinking water, dermal contact while showering, and inhalation of volatile contaminants.

6.1.3 Toxicity Assessment

The HHRA utilized the EPA's recommended hierarchy to obtain toxicity values for the risk assessment. The EPA's Integrated Risk Information System (IRIS) was the primary source used to gather toxicity values. If the required toxicity values were not available in IRIS, Tier 2 values were obtained from the EPA's National Center for Environmental Assessment (NCEA) Provisional Peer Reviewed Toxicity Value Database and Risk Assessment Issue Papers when available. Tier 3 values were gathered from the California Environmental Protection Agency's, Office of Environmental Health Hazard Assessment Toxicity Criteria Database, the Agency of Toxic Substances and Disease Registry's Minimal Risk Levels, or the EPA's Health Effects Assessment Summary Tables. The EPA Region 9 Preliminary Remediation Goals Table was also consulted for toxicity information.

There are varied provisional carcinogenic toxicity values proposed for TCE. The 2001 draft EPA document, *Trichloroethylene Health Risk Assessment: Synthesis and Characterization*, provided several cancer slope factors for TCE that were more conservative than those provided in the 1985 health assessment document for TCE and 1987 addendum. Both the most conservative of the draft slope factors from the 2001 draft document and the original provisional values provided in the 1985 health assessment document and 1987 addendum were used to assess the cancer risk posed by TCE. There are also varied provisional non-carcinogenic oral toxicity values proposed for TCE. Both the oral reference dose from the 2001 draft document and the original provisional oral reference dose were used to assess the noncancer hazard posed by TCE. Given the range in toxicity values, total lifetime excess cancer risks and total hazard indices were expressed as potential ranges in the assessment.

6.1.4 Risk Characterization

For carcinogens, risks are expressed as the incremental probability of an individual's likelihood of developing cancer over a lifetime as a result of exposure to the carcinogen (Table 6-3). These risks are generally expressed in scientific notation (e.g., $1x10^{-6}$).

An excess cancer risk of $1x10^{-6}$ indicates that an individual experiencing the reasonable maximum exposure estimate has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an "excess lifetime cancer risk" because it is in addition to the risks of cancer an individual faces from all other causes. The chance of any given individual developing cancer from all other causes has been estimated to be as high as one in three. In general, the EPA requires or undertakes remedial actions for Superfund sites when the excess cancer risk exceeds $1x10^{-4}$ or 1 in 10,000.

Excess lifetime cancer risk is calculated from the following equation:

Risk=CDI x SF

where: risk = a probability (e.g., $2x10^{-5}$) of an individual developing cancer
CDI = chronic daily intake averaged over 70 years (mg/kg-day)
SF = slope factor, expressed as $(mg/kg\text{-}day)^{-1}$

The potential for non-carcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., lifetime) with a reference dose (RfD) derived for a similar exposure period. A RfD represents a level that an individual may be exposed to that is not expected to cause any deleterious effect (Table 6-4). The ratio of exposure to toxicity is called a hazard quotient (HQ).

The Hazard Index (HI) is generated by adding the HQs for all contaminants that affect the same target organ (e.g., liver) or that act through the same mechanism of action within a medium or across all media to which a given individual may reasonably be exposed. A HI less than one indicates that toxic non-carcinogenic effects from all contaminants are unlikely. An HI greater than one indicates site-related exposures may present a risk to human health.

The HQ is calculated as follows:

Non-cancer HQ = CDI/RfD

where: CDI = chronic daily intake
RfD = reference dose

6.1.5 Conclusions

As previously stated, based on existing conditions at the site, no known current exposures are occurring above drinking water MCLs. Therefore, the HHRA only estimated lifetime excess carcinogenic risks and evaluated the potential for non-carcinogenic health effects from potential future exposure to impacted groundwater for the OU1 area.

For the future residential scenario, the highest excess cancer risk in OU1 is 2.1×10^{-3} (Table 6-5A) and the highest non-carcinogenic HI at OU1 is 8 (Table 6-6A). These risks are based on a time-weighted average approach to modeling risks to an individual living near the site from birth through adulthood. The future resident's daily intake of contaminated groundwater includes drinking water ingestion, dermal contact with contaminated groundwater while showering, and inhalation of contaminated air from domestic water use.

For the future commercial/industrial scenario, the highest excess cancer risk in OU1 is 8.8×10^{-4} (Table 6-5B) and the highest non-carcinogenic HI at OU1 is 3 (Table 6-6B). The future commercial/industrial worker's intake of contaminated groundwater includes drinking water ingestion, dermal contact with contaminated groundwater while showering, and inhalation of contaminated air from water use.

For both the future residential and future commercial/industrial scenarios, the DHSS found that the potential exists for unacceptable carcinogenic risk using groundwater affected by the Highway AF and TRW Plumes. Also, for both scenarios, the potential exists for adverse non-carcinogenic effects from exposure to the TRW Plume. For the Highway AF Plume, the potential for adverse non-carcinogenic effects exists for only the future residential scenario. COS09 and COS10 were within the EPA carcinogenic target risk range and non-carcinogenic effects are not expected to occur for either scenario.

6.1.6 Uncertainty Analysis

There are several areas of uncertainty, which are part of the human health risk assessment and were considered when making decisions regarding the risk posed by the site groundwater contamination. These uncertainties were also considered when choosing the OU1 interim remedy.

A large source of uncertainty is the varied toxicity values for TCE. In order to reduce uncertainty and provide a range of potential cancer risks, the most conservative of the draft slope factors from the 2001 draft TCE health risk assessment was used to assess the high-end of potential cancer risks along with the original provisional values to assess the low-end of the potential risks. Additionally for the groundwater scenarios, both the oral reference dose from the 2001 draft TCE health risk assessment and the original provisional oral reference dose were used to assess the potential for adverse non-carcinogenic health effects. (HHRA, June 2005)

It should also be noted that the TCE draft carcinogenic toxicity value presented in this assessment was derived from an oral exposure study. The value used to assess the high-end cancer risks, however, was applied to inhalation exposures as well as oral exposures. Such route-to-route extrapolations typically introduce additional uncertainty, which may lead to an overestimation of risk. Data presented in the draft toxicity assessment for TCE demonstrates that route extrapolation is supported due to the similar effects seen by both oral and inhalation exposures, which suggests that TCE reaches target sites within the body after absorption from either exposure route. (HHRA, June 2005)

The following uncertainties could lead to overestimation of the risk from OU1:

1. The estimation of risk posed by this site is complex and involves making a series of assumptions to determine chemical intake and toxicity.

2. In the modeling, the daily contaminant intake was established using a number of different variables, many of which are upper confidence limits of the mean values.

3. In the modeling of the contaminant uptake, chemical concentrations were assumed to remain constant over the exposure period.

4. The assumption of 100% bioavailability of chemicals in the environmental media.

5. The oral slope factors were used (oral-to-dermal extrapolation) to assess dermal exposure scenarios since percutaneous factors are not available for COPCs.

The following uncertainties could lead to an overestimation or underestimation of the risk from OU1:

1. The degree to which transport or release models are representative of the physical reality.

2. Most toxicity values used to calculate risk are derived from toxicity testing carried out on animals. Interspecies variation, as well as intraspecies variation, adds uncertainty to the toxicity values.

3. Risk estimates are assumed additive in the absence of information indicating synergism.

4. During the remedial investigation, groundwater monitoring was conducted by sampling the wells at various times seasonally and by the number of wells sampled.

The following uncertainties could lead to an underestimation of the risk from OU1:

1. The recovery of contaminants during sample extraction may be less than 100%.

2. Incremental risks associated with exposure to site-related COPCs may not be fully characterized due to unknown additive or synergistic effects.

3. During the remedial investigations of the site, different analytical methods were used to analyze groundwater samples for VOCs, including Method 8260 for earlier samples and Methods 502.2 and 524.2 for more recent samples.

4. Toxicity values were not available for all COPCs in the risk assessment. So risk could not be quantitatively characterized for all contaminants.

6.2 Screening Level Ecological Risk Assessment

The EPA, Region VII issued a final document entitled "Screening Level Ecological Risk Assessment (SLERA), Oak Grove Village Well site, and LaJolla Spring Cave Complex" dated December 2004. In this document, the potential impacts to ecological receptors exposed to TCE were evaluated. The only ecological risk identified for the OGV site was a potential toxicological risk to Gray Bats and Eastern Pipistrelle Bats in the LaJolla Spring Cave Complex. Since the LaJolla Spring Cave Complex is located in OU2, not OU1, the discussion of the SLERA for OU1 is hereby complete and will not be carried forward in this interim ROD for OU1. The SLERA document is part of the Phase II RI and Post-Phase II RI, and can be found in the Phase II RI and Post-Phase II RI reports and as an independent document in the Administrative Record.

6.3 Conclusions

The interim remedy selected in this ROD is necessary to protect the public health and environment from actual or threatened releases of contaminants from the OGV site, which may present an imminent and substantial endangerment to public health or welfare.

7.0 Remedial Action Objectives

Remedial Action Objectives (RAOs) are descriptions of what the cleanup levels and the overall remedy are expected to accomplish as set forth in this ROD for Interim Action. The OU1 RAOs are media-specific cleanup goals that are protective of human health and the environment. The primary RAOs will deal directly with the protection of human health. The secondary RAOs will require a long-term implementation period, and as such, cannot be implemented in a timeframe that will remediate the aquifer for unrestricted use in the near future. Contamination in groundwater that is pumped from the aquifer will be required to meet the cleanup levels discussed in Section 7.1 in order to achieve RAOs.

The primary RAOs established for groundwater in OU1 are to:

- Prevent exposure to the COC (TCE) by providing residential well users with a water supply that, at a minimum, meets the residential cleanup level, and

- Prevent exposure to the COC (TCE) by providing commercial/industrial well users with a water supply that, at a minimum, meets the commercial/industrial cleanup level.

These two RAOs are considered primary since they directly affect protection of human health by providing potable sources of water and water that does not pose health risks when used for other purposes.

The secondary RAO for groundwater in OU1 is:

- Remediation of the actual contamination in groundwater.

This RAO is considered secondary since it cannot be implemented in a time frame that will protect current and near future users of groundwater.

7.1 Selection of Cleanup Level

In order to meet the RAOs for OU1, cleanup levels were established for the COC (TCE). Numerical clean-up levels are developed to be protective of human health and the environment. The cleanup level chosen was based on the lowest or most conservative level at which the COC could be quantified in a laboratory. The lowest level for TCE was the federal and Missouri MCL and the Missouri Water Quality Standard (MWQS). The MCLs are numerical drinking water standards established to protect human health, and the MWQS is the Missouri criteria for groundwater protection. Each of these values can be found in Table 7-1 for the COC in groundwater.

8.0 Description of Remedial Alternatives

From the screening of technologies, the DNR evaluated and assembled a range of alternatives. The alternatives are listed below.

- Alternative I – No Action
- Alternative II – Treatment at Private Wellheads, Groundwater Monitoring, and ICs
- Alternative III – Alternate Water Supply/Treatment at Private Wellheads, Groundwater Monitoring, and ICs
- Alternative IV – Treatment at Private Wellheads, Groundwater Monitoring, ICs, and Operation/Monitoring of Air Stripper
- Alternative V – Alternate Water Supply/Treatment at Private Wellheads, Groundwater Monitoring, ICs, and Operation/Monitoring of Air Stripper

8.1 Description of Remedy Components

8.1.1 No Action

No Action serves as a baseline for the comparison to other remedial alternatives. The No Action component would not provide protection against contamination in groundwater through monitoring or control. Therefore, it should only be used in situations where no contamination in groundwater is found above the cleanup level (i.e. where no residential or commercial/industrial wells exceed the cleanup level).

8.1.2 Informational ICs

Informational ICs would provide an extra layer of protection against the contamination in groundwater. The Informational ICs for the site consist of educational outreach, including development and distribution of materials to well owners and to individuals applying for permits to drill new wells within the impacted area. These materials would be distributed through the DNR and the county health department. The EPA would post signs indicating the appropriate uses of any domestic wells that are replaced by an alternate water supply (city water) or a modified by a treatment system due to contamination above the cleanup level.

8.1.3 Plug and Abandon

Plug and Abandon consists of removing groundwater wells from use by abandoning and plugging the well following the "Missouri Well Construction Rules." (10 CSR 23.3.110). For OGV01, which is a public water supply well, 10 CSR 23.3.110(2)(C) would apply. This action pertains to wells that no longer meet the cleanup level and are in a condition where treatment of the water is not feasible. The use of this response action assumes that an alternate water source would be, or has been, made available to replace the plugged well.

8.1.4 Groundwater Monitoring

Groundwater Monitoring consists of a well survey and monitoring of the groundwater at residential, commercial/industrial, municipal and monitoring wells to ensure the safety of the water source. The well survey would provide a mechanism to locate any additional residential and commercial/industrial wells in OU1 for inclusion in the monitoring of the groundwater in OU1. Wells not previously sampled would be included in future groundwater sampling to determine the status of the new wells and a course of action, if needed. The well survey would be updated during the five-year review or as needed.

8.1.5 Treatment at Wellhead

Treatment at Wellhead consists of treating groundwater that exceeds the cleanup level by extracting water and treating it at or near the wellhead in OU1. The use of this response action may consist of different treatment methods depending on the treatment efficiency, volumes of water, and the contaminants present.

8.1.6 Alternate Water Supply

Alternate Water Supply consists of replacing current groundwater wells that exceed the cleanup level with an alternate water supply (city water). The use of this response action would be based on whether it is more technologically feasible and economical to supply an alternate source of water (city water), or to treat existing sources.

8.1.7 Operation/Monitoring of the Air Stripper

Operation/Monitoring of the Air Stripper consists of the ongoing operation of the OGV02 air stripper by OGV and monitoring the air stripper to evaluate the remediation of TCE in groundwater (aquifer) over time. OGV began operation of OGV02 and its air stripper on April 22, 2005. OGV02 pumps approximately 50,000 gallons of water per day with an average extraction of 50-ppb TCE. Based on these calculations, approximately 1.9 liters of TCE are removed per year. By monitoring groundwater before it enters the air stripper, the impact of this removal would be documented and evaluated to determine the effectiveness of the air stripper in remediating the aquifer.

In the event OGV stops utilizing OGV02 in the future, the DNR and the EPA should be notified via written letter to determine if an alternate treatment system or ICs is needed.

8.2 Description of the Interim Remedial Action Alternatives

This section describes the remedial action alternatives (including the no action alternative) that were considered for the OU1 interim action. By combining response actions in Section 8.1, the Remedial Action Alternatives were developed. These alternatives are shown in Table 4-4 and are described below.

8.2.1 Remedial Action Alternative I – No Action

Remedial Action Alternative I consists of taking no action to remediate, treat or monitor any of the groundwater groups in OU1, however, five-year reviews for OU1 would need to be conducted. This alternative serves as a baseline against which other alternatives would be compared.

8.2.2 Remedial Action Alternative II – Treatment at Private Wellheads, Groundwater Monitoring, and ICs

Remedial Action Alternative II consists of the following actions from Section 8.1:

- Plug and abandon OGV01 to prohibit exposure to contamination in groundwater.
- Treatment at the wellhead at those residential wells that exceed the cleanup level; well survey and inventory; and monitor the groundwater at other residential wells in OU1 to ensure the safety of the water source.
- Treatment at the wellhead at those commercial/industrial wells that exceed the cleanup level; well survey and inventory; and monitor the groundwater at other commercial/industrial wells in OU1 to ensure the safety of the water source.

- Informational ICs including the development and distribution of educational materials and placement of signs on wells where needed.
- Conduct five-year reviews.

8.2.3 Remedial Action Alternative III – Alternate Water Supply/Treatment at Private Wellheads, Groundwater Monitoring, and ICs

Remedial Action Alternative III consists of the following actions from Section 8.1:

- Plug and abandon OGV01 to prohibit exposure to contamination in groundwater.
- Treatment using an alternate water supply or treatment at the wellhead at those residential wells that exceed the cleanup level; well survey and inventory; and monitor the groundwater at other residential wells in OU1 to ensure the safety of the water source.
- Treatment using an alternate water supply or treatment at the wellhead at those commercial/industrial wells that exceed the cleanup level; well survey and inventory; and monitor the groundwater at other commercial/industrial wells in OU1 to ensure the safety of the water source.
- Institutional ICs including the development and distribution of educational materials and placement of signs on wells where needed.
- Conduct five-year reviews.

8.2.4 Remedial Action Alternative IV – Treatment at Private Wellheads, Groundwater Monitoring, ICs, and Operation/Monitoring of Air Stripper

Remedial Action Alternative IV consists of the following actions from Section 8.1:

- Plug and abandon OGV01 to prohibit exposure to contamination in groundwater.
- Treatment at the wellhead at those residences that exceed the cleanup level; well survey and inventory; and monitor the groundwater at other residential wells in OU1 to ensure the safety of the water source.
- Treatment at the wellhead at those commercial/industrial wells that exceed the cleanup level; well survey and inventory; and monitor the groundwater at other commercial/industrial wells in OU1 to ensure the safety of the water source.
- Operation and Monitoring of the air stripper on OGV02.

- Informational ICs including the development and distribution of educational materials and placement of signs on wells where needed.

- Conduct five-year reviews.

8.2.5 Remedial Action Alternative V – Alternate Water Supply/Treatment at Private Wellheads, Groundwater Monitoring, ICs, and Operation/Monitoring of Air Stripper

Remedial Action Alternative V consists of the following actions from Section 8.1:

- Plug and abandon OGV01 to prohibit exposure to contamination in groundwater.

- Treatment using an alternate water supply or treatment at wellhead at those residences that exceed the cleanup level; well survey and inventory; and monitor the groundwater at other residential wells in OU1 to ensure the safety of the water source.

- Treatment using an alternate water supply or treatment at wellhead at those commercial/industrial wells that exceed the cleanup level; well survey and inventory; and monitor the groundwater at other commercial/industrial wells in OU1 to ensure the safety of the water source.

- Operation and Monitoring of the air stripper on OGV02.

- Informational ICs including the development and distribution of educational materials and placement of signs on wells where needed.

- Conduct five-year reviews.

9.0 Description of the Evaluation Criteria

The nine criteria, as outlined in the NCP, are used to compare the different remedial action alternatives individually and against each other in order to select a remedy. The EPA developed a three-tiered hierarchy for selecting a remedy as follows:

- Two threshold criteria including: (1) Overall Protection of Human Health and the Environment and (2) Compliance with ARARs.

- Five balancing criteria including: (1) Long-Term Effectiveness and Permanence, (2) Reduction of Toxicity, Mobility, or Volume through Treatment, (3) Short-Term Effectiveness, (4) Implementability, and (5) Cost.

- Two modifying criteria including: (1) State (or Support Agency) Acceptance, and (2) Community Acceptance.

These nine evaluation criteria are described below.

9.1 Threshold Criteria

Each alternative must meet the following two threshold criteria:

9.1.1 Overall Protection of Human Health and the Environment

This evaluation criterion is used to assess whether each alternative, as a whole, achieves and maintains protection of human health and the environment. This overall assessment of protectiveness is derived from other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with the ARARs that are applicable to this interim action.

9.1.2 Compliance with ARARs/TBCs

Section 121(d) of CERCLA, 42 U.S.C. Section 6921(d), requires that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate federal and state requirements, standards, criteria, and limitations that are collectively referred to as ARARs, unless such ARARs are waived under CERCLA.

Applicable requirements are those substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address hazardous substances, the remedial action to be implemented at the site, the location of the site, or other circumstances present at the site.

Relevant and appropriate requirements are those substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law which, while not applicable to the hazardous materials found at the site, the remedial action itself, the site location, or other circumstances at the site, nevertheless address problems or situations sufficiently similar to those encountered at the site that their use is well suited to the site.

Compliance with ARARs evaluates whether a remedy meets federal and state environmental statutes, regulations, and other requirements that pertain to OU1 or whether a waiver is justified.

9.2 Balancing Criteria

Each alternative would also be evaluated against the following five balancing criteria:

9.2.1 Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence considers the ability of an alternative to maintain reliable protection of human health and the environment over time.

9.2.2 Reduction of Toxicity, Mobility, or Volume Through Treatment

Reduction of toxicity, mobility, or volume of contaminants through treatment evaluates an alternative's use of treatment to reduce harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.

9.2.3 Short-term Effectiveness

Short-term effectiveness addresses the period of time needed to implement a remedial action alternative. It also addresses any adverse impacts of the remedial action alternative that may be posed to workers, the environment, and the community during the construction and implementation (operation) phase of the remedial action until remedial response objectives are achieved (e.g., a remediation goal has been achieved).

9.2.4 Implementability

Implementability addresses the technical and administrative feasibility of implementing a remedial action alternative such as the relative availability of services and materials, administrative feasibility, and coordination with other governmental entities.

9.2.5 Cost

Cost includes the direct and indirect capital costs, periodic costs, operation and maintenance (O&M) costs as well as total costs and present worth costs. The direct costs include all capital costs, including the labor and materials needed to implement the remedial action alternative. The indirect costs include expenditures for engineering, financial, and other services that are not part of actual installation activities, yet are required to complete the installation of remedial action alternatives. O&M costs include the costs necessary to operate the systems for each remedial action alternative. Present worth cost is the total cost of a remedial action alternative over time in terms of today's dollar cost. Cost estimates are expected to be accurate within a range of +50 to -30 percent.

9.3 Modifying Criteria

This evaluation criterion includes the two criteria discussed below.

9.3.1 State (Support Agency) Acceptance

This assessment evaluates the technical and administrative issues and concerns the EPA, as the support agency in the case of state-lead sites, has regarding each of the remedial action alternatives. The EPA acceptance considers whether the EPA agrees with the state's analyses and recommendations of the Post-Phase II RI/FS and the Proposed Plan for Interim Action for OU1.

9.3.2 Community Acceptance

Community acceptance considers whether the local community agrees with the state's analyses and the preferred alternative. Comments received on the Proposed Plan for Interim Action for OU1 are important indicators of community acceptance.

10.0 Comparative Analysis of Interim Action Remedial Alternatives

This section presents the comparative analysis of the individual remedial action alternatives for this interim action. This section of the ROD profiles the relative performance of each alternative against the nine criteria, noting how it compares to the other options under consideration. The nine evaluation criteria were discussed in Section 9.0. The complete detailed analysis of alternatives can be found in the Post-Phase II FS Report. Table 10-1 summarizes the comparative analysis of the remedial action alternatives.

As required, the DNR evaluated the alternatives using the nine criteria listed in Section §300.430 of the National Contingency Plan (NCP). If an alternative does not meet the threshold criteria, it cannot be considered as the site remedy. With respect to the balancing criteria, the DNR can make tradeoffs between the different alternatives. Along with these criteria, the modifying criteria are evaluated to determine the most appropriate action for the site.

10.1 Overall Protection of Human Health and the Environment

Remedial Action Alternative I does not satisfy this threshold criterion or provide for the overall protection of human health and the environment in OU1 since no actions would be implemented to improve current conditions.

Remedial Action Alternatives II through V satisfy this threshold criterion and provide for the overall protection of human health and the environment since actions would be implemented to adequately protect current and future receptors of groundwater in OU1. Informational ICs will provide an extra layer of protection against the contamination in groundwater. The distribution of the educational materials to current and future well owners would raise future awareness of the site contamination. Signs posted on any wells with an exceedance of the cleanup level would indicate the appropriate uses of the well. The well inventory would monitor all OU1 wells assuring the completeness of the groundwater monitoring. Groundwater monitoring of wells within OU1 and the five-year reviews would demonstrate that the selected remedy is protecting human health and the environment in OU1.

Remedial Action Alternatives II and IV would provide treatment at the wellhead for all wells that exceed the cleanup level. For all other wells with contamination in groundwater, active groundwater monitoring would occur to assure the wells in OU1 remain safe for use.

Remedial Action Alternatives III and V would provide an alternative water supply (city water) where feasible for all wells that exceed the cleanup level. Where it is not feasible, treatment at the wellhead would be provided. For all other wells with contamination in groundwater, active groundwater monitoring would occur to assure the wells in OU1 remain safe for use.

For Remedial Action Alternatives IV and V, the operation and monitoring of the OGV02 air stripper would be used to determine its effectiveness in restoring the aquifer.

10.2 Compliance with ARARs/TBCs

Because this is an interim action, only ARAR/TBCs specific to the interim action were considered.

Remedial Action Alternative I does not satisfy this threshold criterion or comply with any ARARs or TBCs since no actions would be implemented to improve current conditions in OU1.

Remedial Action Alternatives II through V satisfy this threshold criterion and comply with ARARs and TBCs since actions would be implemented to improve current conditions in OU1. Limited remediation of contamination in groundwater for the four alternatives would be through the operation and use of the municipal wells, and residential and commercial/industrial wells with wellhead treatment systems. Table 10-2 summarizes the ARARs for each remedial action alternative.

For Remedial Action Alternatives II through V, the continued groundwater monitoring, based on the well inventory in OU1, the educational outreach, the posting of signs on impacted wells, the plugging and abandonment of OGV01, and five-year reviews would indirectly comply with ARARs and TBCs by preventing exposure to the contamination in groundwater via monitoring, education, and prevention (plugging of OGV01).

Alternatives IV and V would provide additional compliance with the ARARs and TBCs due to the monitoring of the air stripper of OGV02. Table 10-2 summarizes the ARARs for each remedial action alternative.

10.3 Long-Term Effectiveness and Permanence

Remedial Action Alternative I would not provide an effective or permanent remedy for OU1 since no actions would be implemented to improve current conditions in OU1. It is not an appropriate remedial action alternative for OU1.

For Remedial Action Alternatives II through V, groundwater monitoring, based on the well inventory of all wells in OU1 and five-year reviews, would demonstrate the long-term effectiveness and permanence of the remedial action and assure the wells in OU1 would remain safe for water use. Long-term effectiveness and permanence can be maintained through the plugging and abandonment of OGV01 and through informational ICs, including educational outreach, and the posting of signs on impacted wells.

Remedial Action Alternatives II and IV would provide treatment at the wellhead for all wells that exceed the cleanup level. These alternatives would provide an effective and permanent source of treated water for the individual residential and commercial/industrial wells with contamination in groundwater that exceed the cleanup level through the use of individual wellhead treatment systems as long as the systems are maintained, rendering the water potable and usable. It will not provide an effective or permanent remedy for the individual wells with site contamination in groundwater that does not exceed the cleanup level since no action other than monitoring will be taken.

Remedial Action Alternatives III and V would provide an alternative water supply (city water) where feasible for all wells that exceed the cleanup level. Where it is not feasible, treatment at the wellhead would be provided. The alternatives would provide for an effective and permanent source of water, via a public water supply system, for individual residential and commercial/ industrial wells with site contamination in groundwater that exceed the cleanup level and are inside the feasible limits of the extended public water supply system. For those individual residential and commercial/industrial wells with site contamination in groundwater that exceed the cleanup level and are outside the feasible limits of the extended public water distribution system, the wellhead treatment as described in Remedial Action Alternatives II and IV will be an effective and permanent remedy. Like Remedial Action Alternatives II and IV, Remedial Action Alternatives III and V will not provide a permanent source of water for individual residential and commercial/industrial wells with site contamination in groundwater that does not exceed the cleanup level.

For Remedial Action Alternatives IV and V, the operation and monitoring of the OGV02 air stripper would be used to determine its effectiveness in restoring the aquifer. For these alternatives, the ongoing operation of the OGV02 air stripper by OGV and monitoring of the air stripper would be used to determine its effectiveness in restoring the aquifer by evaluating the remediation of TCE in groundwater (aquifer) over time. OGV began operation of OGV02 (which is OGV's public water supply well) and the air stripper in April 2005. By monitoring groundwater before it enters the air stripper, this impact would be documented and evaluated to determine the effectiveness of the air stripper in remediating the aquifer.

10.4 Reduction of Toxicity, Mobility or Volume Through Treatment

None of the interim action alternatives provide for treatment to significantly reduce the toxicity, mobility or volume of the groundwater contamination in OU1. Because this action does not constitute the final remedy for OU1, the statutory preference for remedies that employ treatment that reduces toxicity, mobility or volume as a principal element will be addressed by the final response action.

10.5 Short-Term Effectiveness

Remedial Action Alternative I would not be effective in the short-term, nor would it affect the community, workers, or the environment in the short-term since no action would be taken at OU1.

For Remedial Action Alternatives II through V, the continued groundwater monitoring, based on the well inventory of wells in OU1, the educational outreach, the posting of signs on impacted wells, the plugging and abandonment of OGV01, and five-year reviews would be effective in the short-term and pose no additional risks to the community, workers, or the environment.

Remedial Action Alternatives II and IV would be effective in the short-term (treatment at wellhead) for any future wells with contamination in groundwater exceeding the cleanup level. These alternatives would have little or no affect on workers, the environment, or the community in the short-term, while the individual wellhead treatment units are installed on residential and commercial/industrial wells.

Remedial Action Alternatives III and V would be effective in the short-term (alternative water supply or treatment at wellhead) for any future wells with contamination in groundwater exceeding the cleanup level. These alternatives would require heavy construction work for the installation of the possible water supply and distribution lines. However, the use of proper safety precautions for all work will reduce or eliminate the short-term risks to workers, the environment, and the community.

For Remedial Action Alternatives IV and V, the operation and maintenance of the OGV02 air stripper would be effective in the short-term and pose no short-term risks to workers, the environment, and the community.

10.6 Implementability

Remedial Action Alternative I requires no implementation since no action would be taken at OU1.

For Remedial Action Alternatives II through V, the continued groundwater monitoring, based on the well inventory of wells in OU1, the educational outreach, the posting of signs on impacted wells, the plugging and abandonment of OGV01, and five-year reviews would be easy to implement.

Remedial Action Alternatives II and IV would require the installation and subsequent maintenance of treatment units on any future well with contamination in groundwater exceeding the cleanup level. Only with the well owner's acceptance and cooperation, would the installation and subsequent maintenance be easy to implement.

Remedial Action Alternatives III and V would require access agreements for the installation of water distribution lines. Only with community acceptance and cooperation would the obtaining access agreements be easy to implement.

For Alternatives IV and V, the operation and maintenance of the OGV02 air stripper would be easy to implement with community acceptance and cooperation.

10.7 Costs

The estimated costs for the alternatives are as follows:

Criteria	Alternative I	Alternative II	Alternative III	Alternative IV	Alternative V
Capital Costs	$0	$39,703	$327,916	$39,703	$327,916
O&M Costs	$0	$1,353,000	$1,563,000	$1,454,010	$1,664,010
Periodic Costs	$300,000	$300,000	$300,000	$300,000	$300,000
Total Costs	$300,000	$1,692,703	$2,190,916	$1,793,713	$2,291,926
Present Worth	$107,800	$707,149	$1,082,225	$748,930	$1,124,006

11.0 Summation of Comparative Analysis

Remedial action alternatives for this interim action were assembled from the response actions identified in section 8.1. The alternatives were evaluated and compared to the nine criteria required by the National Contingency Plan (NCP). In addition to the active remedial action alternatives, the NCP requires that a no action alternative be considered. The following five alternatives were considered in the Post-Phase II FS for OU1 and the Proposed Plan for Interim Action for OU1 to address the site contamination in groundwater.

SUMMARY OF REMEDIAL ALTERNATIVES OAK GROVE VILLAGE WELL SITE, OPERABLE UNIT 1	
Designation	**Description**
I	**No action**
II	**Treatment at Private Wellheads, Groundwater Monitoring, and ICs**
III	**Alternative Water Supply/Treatment at Private Wellheads, Groundwater Monitoring, and ICs**
IV	**Treatment at Private Wellheads, Groundwater Monitoring, ICs, and Operation/Monitoring of Air Stripper**
V	**Alternative Water Supply/Treatment at Private Wellheads, Groundwater Monitoring, ICs, and Operation/Monitoring of Air Stripper**

Many of these remedial action alternatives include common components. Except for the "no action" alternative, all remedial action alternatives require the proper plugging and abandonment of OGV01 and the implementation of informational ICs, including the development and distribution of appropriate educational material until the groundwater cleanup level is met. OGV01 will be plugged and abandoned following the Missouri Well Construction Rules 10 CSR 23-4.080 to ensure that the site contaminants in groundwater from OGV01 are not used for potable purposes and other purposes that may pose exposure risks. The informational ICs will consist of educational outreach, including distribution of materials to well owners and to individuals applying for permits to drill new wells within the impacted area. These materials will be distributed through the DNR and the county health department. Any domestic wells that are replaced by an alternate water supply (city water or treatment system) due to contamination above the cleanup level will be posted with signs indicating the appropriate uses of the well.

Alternatives II through V provide clean water sources via the placement of wellhead treatment systems or a connection to the public water supply at those residential and commercial/industrial wells that exceed the RG.

Alternatives II through V also provide for a well survey and monitoring of the groundwater at residential, commercial/industrial, municipal and monitoring wells to ensure the safety of the water source. The well survey will provide a mechanism to locate residential and commercial/industrial wells in OU1 for inclusion in the monitoring of the groundwater in OU1. Wells not previously sampled will be included in future groundwater sampling to determine the new well's status and a course of action. The well survey will be updated during the five-year review or as needed.

Alternatives IV and V provide for the ongoing operation of the OGV02 air stripper by OGV, as well as monitoring of the air stripper and evaluating the remediation of the aquifer. OGV02 pumps approximately 50,000 gallons of water per day with an average extraction of 50-ppb TCE. Based on these calculations, approximately 1.9 liters of TCE are removed per year. Monitoring of the groundwater before it enters the air stripper will document and evaluate the effectiveness of the air stripper's operation in remediating the aquifer.

OGV02 currently has a functioning air stripper to remediate the contaminated water rendering it usable for public consumption and other uses. In the event OGV stops utilizing the air stripper on OGV02 in the future, the DNR and the EPA will be notified via written letter to determine if an alternate remediation system or ICs are needed.

For Superfund sites with contamination that is left on-site or untreated, five-year reviews of the remedial action are required. All alternatives for the OU1 remedial interim action assume five-year reviews will be conducted.

The following sections provide the detailed descriptions of these interim alternatives.

<u>Remedial Action Alternative I – No Action</u>

Remedial Action Alternative I, the No Action alternative, is required by the National Contingency Plan (NCP) for consideration. Alternative I serves as a baseline against which the other alternatives may be compared. Under this alternative; the contaminated groundwater would not undergo treatment and would continue to be used as a drinking water supply that does not meet current drinking water standards and would continue to be used for other purposes that may pose health risks. No action would be taken to supply an alternate water supply, private wells would not be monitored to determine if drinking water meets current drinking water standards, remediation of the aquifer would not be monitored, and no informational ICs would be developed and distributed. OGV01 would not be properly closed or abandoned. However, five-year reviews for OU1 would need to be conducted since contamination in groundwater would go untreated.

The Capital Costs associated with Alternative I are estimated to be $0. The O&M Costs associated with Alternative I are estimated to be $0. The Periodic Costs to conduct five-year reviews, associated with Alternative I, are estimated to be $300,000. The 30-year Total Costs associated with Alternative I are estimated to be $300,000. The Present Worth Costs for Alternative I are estimated to be $107,800.

Remedial Action Alternative II – Treatment at Private Wellhead, Groundwater Monitoring, and ICs

Remedial Action Alternative II, the Treatment at Private Wellheads, Groundwater Monitoring, and ICs alternative, provides for the placement of private wellhead treatment systems at those residential and commercial/industrial wells that exceed the cleanup level. A well survey and inventory, which would be updated during each five-year review or as needed, would provide a mechanism to locate wells for inclusion in the groundwater monitoring for OU1 and determine the status of any new wells included in the survey. Signs would be posted on any wells replaced by a treatment system due to exceedance of the cleanup level, indicating the appropriate uses of the well. Informational ICs including educational material would be distributed to raise future awareness of the site contamination, and five-year reviews would be conducted.

Under this alternative, the following actions would be taken:

- Properly plug and abandon OGV01 to prohibit exposure to contamination in groundwater.

- Provide treatment at wellhead at homes with residential wells and at businesses with commercial/industrial wells with site contamination in groundwater that exceeds the cleanup level.

- Conduct groundwater sampling of residential and commercial/industrial wells with treatment at wellhead, and of residential, commercial/industrial, municipal, and monitoring wells, which are part of the OU1 well inventory. The sampling of wells, which are part of the well inventory, would ensure the safety of the residential and commercial/industrial well water sources and would detect any wells that may exceed the cleanup level.

- Implement informational ICs including the development and distribution of educational materials to raise future awareness of the site contamination. Signs would be placed on wells that are replaced by a private wellhead treatment system, indicating the appropriate uses of the well.

- Five-year reviews of the site would be conducted since contamination in groundwater would remain on-site.

The Capital Costs associated with Alternative II are estimated to be $37,708. The O&M Costs for groundwater monitoring and for monitoring of the wellhead treatment systems are estimated to be $1,353,000. The Periodic Costs to conduct five-year reviews, associated with Alternative II, are estimated to be $300,000. The 30-year Total Costs associated with Alternative II are estimated to be $1,690,708. The Present Worth Costs for Alternative II are estimated to be $705,154.

Remedial Action Alternative III –Alternate Water Supply/Treatment at Private Wellheads, Groundwater Monitoring, and ICs

Remedial Action Alternative III, the Alternate Water Supply/Treatment at Private Wellheads, Groundwater Monitoring, and ICs alternative, provides for treatment using an alternate water supply (city water) or treatment at the wellhead at those residences and commercial/industrial wells that exceed the cleanup level. Residential and commercial/industrial wells that exceed the cleanup level, but are outside the feasible limits of extending the city water lines, would be provided with private wellhead treatment systems. A well survey and inventory, which would be updated during each five-year review or as needed, would provide a mechanism to locate wells for inclusion in the groundwater monitoring for OU1 and determine the status of any new wells included in the survey. Signs would be posted on any wells replaced by an alternate water supply (city water) or a treatment system due to exceedance of the cleanup level, indicating the appropriate uses of the well. Informational ICs including educational materials would be developed and distributed to raise future awareness of the site contamination, and five-year reviews would be conducted.

Under this alternative, the following actions would be taken:

- Properly plug and abandon OGV01 to prohibit exposure to contamination in groundwater.

- Provide an alternative water supply via public water distribution system to homes with residential wells and businesses with commercial/industrial wells that have site contamination in groundwater that exceeds the cleanup level and are within the feasible limits of a public water distribution system. Provide private wellhead treatment systems for residential and commercial/industrial wells found outside the feasible limits of extending water lines to a public water distribution system.

- Conduct groundwater sampling of residential and commercial/industrial wells with a treatment system and of residential, commercial/industrial, municipal, and monitoring wells, which is part of the OU1 well inventory. The sampling of wells, which are part of the well inventory, would ensure the safety of the residential and commercial/industrial well water sources and would detect any wells that may exceed the cleanup level. Once a well exceeds the cleanup level, an alternate water supply would be installed to prevent continued exposure to site contaminants.

- Implement informational ICs including the development and distribution of educational materials to raise future awareness of the site contamination. Signs would be placed on wells that are replaced by an alternate water supply (city water or treatment system) indicating the appropriate uses of the well.

- Five-year reviews of OU1 would be conducted since contamination in groundwater would remain on-site.

The Capital Costs associated with Alternative III are estimated to be $327,916. The O&M Costs for groundwater monitoring and for monitoring of the wellhead treatment systems are estimated to be $1,563,000. The Periodic Costs to conduct five-year reviews, associated with Alternative III, are estimated to be $300,000. The 30-year Total Costs associated with Alternative III are estimated to be $2,190,916. The Present Worth Costs for Alternative III are estimated to be $1,082,225.

Remedial Action Alternative IV – Treatment at Private Wellheads, Groundwater Monitoring, ICs, and Operation/Monitoring of Air Stripper

Remedial Action Alternative IV, Treatment at Private Wellheads, Groundwater Monitoring, ICs, and Operation/Monitoring of Air Stripper alternative, is the same as Alternative II, except for the inclusion of the ongoing operation of the OGV02 air stripper by OGV and monitoring of the air stripper to evaluate the remediation of TCE in groundwater over time.

Under this alternative, the following actions would be taken:

- Properly plug and abandon OGV01 to prohibit exposure to contamination in groundwater.

- Provide treatment at wellhead at homes with residential wells and at businesses with commercial/industrial wells with site contamination in groundwater that exceeds the cleanup level.

- Conduct groundwater sampling of residential and commercial/industrial wells with treatment at wellhead, and of residential, commercial/industrial, municipal, and monitoring wells, which are part of the OU1 well inventory. The sampling of wells, which are part of the well inventory, would ensure the safety of the residential and commercial/industrial well water sources and would detect any wells that may exceed the cleanup level. Once a well exceeds the cleanup level, a private treatment system would be installed at the wellhead to prevent continued exposure to site contaminants.

- Monitor OGV02 to ensure that the air stripper provides a clean water supply to OGV, while remediating the groundwater in the cone-of-capture of OGV02.

- Implement informational ICs including the development and distribution of educational materials to raise future awareness of the site contamination. Signs would be placed on wells that are replaced by a private wellhead treatment system indicating the appropriate uses of the well.

- Five-year reviews of OU1 would be conducted since contamination in groundwater would remain on-site.

The Capital Costs associated with Alternative IV are estimated to be $47,680. The O&M Costs for groundwater monitoring and for monitoring of OGV02 and the wellhead treatment systems are estimated to be $1,454,010. The Periodic Costs to conduct five-year reviews, associated with Alternative IV, are estimated to be $300,000. The 30-year Total Costs associated with Alternative IV are estimated to be $1,801,690. The Present Worth Costs for Alternative IV are estimated to be $756,907.

Remedial Action Alternative V - Alternate Water Supply/Treatment at Private Wellheads, Groundwater Monitoring, ICs, and Operation/Monitoring of Air Stripper

Remedial Action Alternative V, the Alternate Water Supply/Treatment at Private Wellheads, Groundwater Monitoring, ICs, and Operation/Monitoring of Air Stripper alternative, is the same as Alternative III, except for the inclusion of the ongoing operation of the OGV02 air stripper by OGV and monitoring of the air stripper to evaluate the remediation of TCE in groundwater over time.

Under Alternative V, the following actions would be taken:

- Properly plug and abandon OGV01 to prohibit exposure to contamination in groundwater.

- Provide an alternative water supply via public water distribution system to homes with residential wells and businesses with commercial/industrial wells that have site contamination in groundwater that exceeds the cleanup level and are within the feasible limits of a public water distribution system. Provide private wellhead treatment systems for residential and commercial/industrial wells found outside the feasible limits of extending water lines to a public water distribution system.

- Conduct groundwater sampling of residential and commercial/industrial wells with treatment at wellhead, and of residential, commercial/industrial, municipal, and monitoring wells, which are part of the OU1 well inventory. The sampling of wells, which are part of the well inventory, would ensure the safety of the residential and commercial/industrial well water sources and would detect any wells that may exceed the cleanup level. Once a well exceeds the cleanup level, a private treatment system would be installed at the wellhead to prevent continued exposure to site contaminants.

- Monitor OGV02 to ensure that the air stripper provides a clean water supply to OGV, while remediating the groundwater in the cone-of-capture of OGV02.

- Implement informational ICs including the development and distribution of educational materials to raise future awareness of the site contamination. Signs would be placed on wells that are replaced by a private wellhead treatment system indicating the appropriate uses of the well.

- Five-year reviews of OU1 would be conducted since contamination in groundwater would remain on-site.

The Capital Costs associated with Alternative V are estimated to be $327,916. The O&M Costs for groundwater monitoring and for monitoring of OGV02 and the wellhead treatment systems are estimated to be $1,664,010. The Periodic Costs to conduct five-year reviews, associated with Alternative V, are estimated to be $300,000. The 30-year Total Costs associated with Alternative V are estimated to be $2,291,926. The Present Worth Costs for Alternative V are estimated to be $1,124,006.

12.0 Principal Threat Wastes

The NCP establishes an expectation that the EPA will use treatment to address the principal threats posed by a site wherever practicable (40 CFR §300.430(a)(1)(iii)(A)). The "principal threat" concept is applied to the characterization of "source materials" at a Superfund site. A source material is material that includes or contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to groundwater, surface water or air, or acts as a source for direct exposure. Contamination in groundwater generally is not considered to be a source material; however, non-aqueous phase liquids (NAPLs) in groundwater may be viewed as a source material.

There are no principal threat wastes in OU1. During the RI and Post-RI, sampling data was collected from over 150 residential, commercial/industrial, municipal, and monitoring wells, 15 springs, multiple surface water and sediment locations from Winsel Creek and the Meramec River, and multiple soil sampling locations. No principal threat wastes were detected in any of these samples.

13.0 Selected Interim Action

This section expands upon the details of the selected interim remedy for OU1, which is presented in the Description of Alternatives Section (Section 8.0) of this ROD for Interim Action.

13.1 Summary of the Rationale for the Selected Interim Action

The selected remedy for the OGV Well Site, Operable Unit 1 will consist of Remedial Action Alternative V – Alternate Water Supply/Treatment at Private Wellheads, Groundwater Monitoring, ICs, and Operation/Monitoring of Air Stripper. The DNR and EPA believe Remedial Action Alternative V will be protective of human health and the environment, will comply with ARARs, will be cost effective, and utilize solutions to the maximum extent practicable for an interim action.

13.2 Description of the Selected Remedy

The selected remedy is designed to prevent unacceptable exposures to contamination in groundwater. The major components of the selected remedy include:

- Properly plug and abandon OGV01 to prohibit exposure to contamination in groundwater.

- Provide an alternate water supply via public water distribution system to homes with residential wells and businesses with commercial/industrial wells that have site contamination in groundwater that exceeds the cleanup level and are within the feasible limits of a public water distribution system. Provide private wellhead treatment systems for residential and commercial/industrial wells found outside the feasible limits of extending water lines to a public water distribution system.

- Conduct groundwater sampling of residential and commercial/industrial wells with treatment at wellhead, and of residential, commercial/industrial, municipal, and monitoring wells, which are part of the OU1 well inventory. The sampling of wells, which are part of the well inventory, would ensure the safety of the water sources supplied to homes and businesses and would detect any new wells that may exceed the cleanup level. Once a well exceeds the cleanup level, it would be connected to an alternate water supply (city water) or a private treatment system would be installed at the wellhead to prevent continued exposure to site contamination in groundwater.

- Monitor OGV02 to ensure that the air stripper continues to provide a clean water supply to OGV, while remediating the groundwater within the cone-of-capture of OGV02.

- Implement informational ICs, including the development and distribution of educational materials to raise future awareness of the site contamination. Signs would be placed on wells that are replaced by a private wellhead treatment system indicating the appropriate uses of the well. The need for any additional ICs will be evaluated over the course of this interim action. If additional ICs are necessary, they will be implemented as part of the final remedy.

- Five-year reviews of OU1 would be conducted since contamination in groundwater would remain on-site.

The selected remedial action, if properly implemented and properly maintained, will achieve substantial risk reduction by removing the exposure pathways to residential homes and commercial properties that could be impacted by site related contamination in groundwater. In addition, it will ensure that new exposure pathways to OU1 wells are not created through plume migration. The monitoring program will also provide data to determine if meeting the secondary RAO of remediating the contamination in groundwater is feasible.

13.3 Summary of Estimated Costs

The detailed cost summary of the capital, O&M, and the periodic costs associated with the implementation of Remedial Action Alternative V is presented in Table 13-1. The information in the cost estimate is based on the best available information regarding the anticipated scope of the remedial action alternative. Changes in the cost elements could occur as a result of new information and data collected during the engineering design of the remedial alternative. Major changes may be documented in the form of a memorandum to the Administrative Record file, an Explanation of Significant Differences (ESD), or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to –30 percent of the actual project costs.

The capital costs include both direct and indirect capital costs. The direct capital costs include the development of education materials, the plugging and abandonment of OGV01, the establishment of the well inventory for OU1, and either the connection to an alternate water supply (city water) or the installation of a wellhead treatment system on impacted residential and/or commercial/industrial wells. With the addition of indirect costs, the total capital costs associated with Alternative V are estimated to be $327,916.

The O&M costs associated with implementing this remedial action alternative include groundwater monitoring of residential, commercial/industrial, municipal, and monitoring wells; the maintenance of the alternate water supply (city water) or the wellhead treatment system on impacted wells; and the mathematical calculation of the extracted contamination from groundwater (aquifer). The total O&M cost per year associated with Alternative V is estimated to be $55,467, with the total O&M costs for thirty-years of $1,664,010.

The periodic costs associated with implementing this remedial action alternative include conducting statutory five-year reviews over a thirty-year period. The periodic costs to conduct five-year reviews, associated with Alternative V, are estimated to be $50,000 per year, with the total periodic cost for thirty-years of $300,000.

The 30-year Total Costs associated with Alternative V are estimated to be $2,291,926. The total Present Worth Costs for Alternative V is estimated to be $1,124,006.

13.4 Expected Outcomes of the Selected Interim Action

The selected remedy will achieve substantial risk reduction by removing the exposure pathways to residential and commercial/industrial properties that could be impacted by OU1 contamination in groundwater. The remedy ensures that current and future residents and workers are supplied with an unrestricted water supply, which will be protective of human health. The remedy will ensure that new exposure pathways to OU1 wells are not created through plume migration. The monitoring program will also provide data to determine if meeting the secondary RAO of remediating the contamination in groundwater is feasible.

To reduce the possibility of new homes installing wells that will become contaminated, the selected remedy will allow for the development and distribution of educational materials to well owners and drillers. However, OGV and Sullivan are close to St. Louis and development is expected to continue into the future at the same rate or faster within and outside the communities. As development continues within OGV and Sullivan, new residences, new or expanded businesses, and light industry will be added to the current municipal water supplies. This additional growth will ultimately stretch the current municipal water supplies, forcing the municipalities to expand the public water distribution systems. Outside both communities, any new development will need to either tie onto the current water supplies or new individual wells will have to be drilled to supply needed water. In areas where wells are the only option, the new wells will be sampled to verify the existence of, or lack of, contamination in the wells.

If the new wells have contamination in groundwater above the cleanup level and they are within the feasible limits of a public water distribution system, then the home or business will be connected to the public water distribution system, thus preventing the exposure of site contamination in groundwater. If the new wells have contamination in groundwater above the cleanup level and they are outside the feasible limits of a public water distribution system, then an individual treatment system will be installed on the individual residential or commercial / industrial well, thus preventing exposure to contamination in groundwater. Even though the new well may cause the spread of contamination in groundwater, the individual treatment system at the wellhead will strip the contamination from the groundwater (plume migration control and remediation) before use.

13.5 Support Agency Acceptance

The EPA supports the selected alternative, Remedial Action Alternative V, as proposed by the DNR, over the other remedial action alternatives.

13.6 Community Acceptance

During the public comment period, the community generally expressed its support for Remedial Action Alternative V, as proposed by the DNR. The DNR received written and verbal comments during the public meeting for the Proposed Plan for Interim Action. The verbal and written public meeting comments and the DNR's responses to the comments are located in the Responsiveness Summary Section of this ROD.

14.0 Statutory Determinations

The selected interim remedy is protective of human health and the environment in the short term and is intended to provide adequate protection until the final ROD is signed; complies with (or waives) those federal and state requirements that are applicable or relevant and appropriate requirements (ARARs) for this limited-scope action; and is cost-effective (Table 14-1). This action is an interim solution only, and is not intended to utilize permanent solutions and alternative treatment technologies to the maximum extent practicable for this OU. Because this action does not constitute the final remedy for OU1, the statutory preference for remedies that employ treatment that reduces, toxicity, mobility, or volume as a principle element will be addressed by the final response action. Because this remedy will result in hazardous substances remaining on-site above health-based levels that allow for unlimited use and unrestricted exposure until the remedial action is complete, statutory reviews will be conducted every five years after commencement of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment. Because this is an interim action ROD, review of this site and remedy will be ongoing as the EPA continues to develop remedial alternatives for OU1.

The following sections discuss how the selected remedy meets these statutory requirements.

14.1 Protection of Human Health and the Environment

The selected remedial alternative for the interim action at OU1, Alternative V, will protect human health and the environment from the contamination in groundwater. The limited hydraulic extraction of the contamination in groundwater, and the subsequent treatment of the extracted groundwater will eliminate the groundwater exposure pathway through which contaminants pose risks. Due to the depth and concentration of the contamination, the concentrations of VOCs in the air emissions are expected to be below federal and state standards and not expected to require treatment to meet federal and state air emission. The distribution of educational materials to well owners and well drillers will educate them to the potential risks the contamination in groundwater could pose.

The selected remedial action, if properly implemented and properly maintained, will achieve substantial risk reduction by removing the exposure pathways to residential homes and commercial properties that could be impacted by site related contamination in groundwater. In addition, it will ensure that new exposure pathways to OU1 wells are not created through plume migration. The monitoring program will also provide data to determine if meeting the secondary RAO of remediating the contamination in groundwater is feasible.

14.2 Compliance with Applicable or Relevant and Appropriate Requirements

Section 121(d)(2) of CERCLA, 42 USC §9621(d)(2), requires that cleanup actions conducted under CERCLA achieve a degree or level of cleanup which, at a minimum, attains "any standard, requirement, criteria, or limitation under a state environmental or facility siting law that is more stringent than any federal standard... (which) is legally applicable to the hazardous substance or pollutant or contaminant concerned or is relevant and appropriate under the circumstances of the release or threatened release of such hazardous substance or pollutant of contaminant..." The identified standards, requirements, criteria, or limitations thus adopted from other environmental laws, which govern on-site cleanup activities at OU1, are referred to as ARARs (Table 14-2).

This section identifies the ARARs, which the selected remedy is expected to meet:

- National Drinking Water Standards - Safe Drinking Water Act (40 CFR Part 141), Missouri Drinking Water Regulations (40 RSMo Ch. 644; 10 CSR 60) and Missouri Water Quality Standards (10 CSR 20, Ch. 7): Establishes MCLs and MWQS for a number of common VOCs including site COPCs. These levels regulate the concentrations of contaminants in public drinking water supplies and are considered relevant and appropriate for groundwater aquifers potentially used for drinking water. The treatment of extracted groundwater by air stripping or carbon filtration or by providing an alternate water source will meet the ARARs for drinking water.
- Clean Water Act (42 USC 7401-7671; 40 CFR 50 and 61): Emissions exceeding 10 tons/year of any Hazardous Air Pollutant (HAP) or an aggregate of 25 tons/year of a combination of HAPs would require that the best available control technology be applied in the event that these levels are exceeded. It is not anticipated that discharges to the air would reach these levels. Future emissions (such as dust) would need to be controlled during possible excavation and construction activities.
- Missouri Well Construction Rules (RSMo Ch. 256.600 to 256.64; 4, 10 CSR 23-3.11 & 22-3.110): These rules should be used when OGV01 is plugged and abandoned.

In addition, all remedial action activities for OU1 would need to comply with Occupational Safety and Health Administration requirements.

14.3 Cost Effectiveness

The DNR believes the selected remedy is cost-effective, providing an overall effectiveness proportional to its cost. In making this determination, the following definition was used: "A remedy shall be cost-effective if its costs are proportional to its overall effectiveness" (40 CFR §300.430(f)(1)(ii)(D)). This was accomplished by evaluating the "overall effectiveness" of the remedial action alternatives that satisfied the threshold criteria (i.e., were both protective of human health and the environment and met ARARs). Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness). Overall effectiveness was then compared to costs to determine cost-effectiveness. The relationship of the overall effectiveness of the selected remedy was determined to be proportional to the cost, and hence the selected remedy represents the most economically reasonable alternative for this interim action (Table 10-1).

14.4 Utilization of Permanent Solutions and Alternative Treatment Technology to the Maximum Extent Practicable

Of those alternatives that are protective of human health and the environment and comply with ARARs, the state and EPA have determined that this interim action is not designed or expected to be final, but that the selected remedy represents the best balance of trade-off among the alternatives with respect to pertinent criteria, given the limited scope of the action. Although the source materials for the contamination are currently unknown, the selected remedy treats, in a limited capacity, the primary threats posed by the VOC contamination in groundwater while achieving some VOC reduction.

14.5 Preference for Treatment Which Reduces Toxicity, Mobility, or Volume

By hydraulically containing and extracting groundwater, the selected remedy treats, in a limited capacity, the primary threats posed by the VOC contamination in groundwater while achieving some VOC reduction. However, because this action does not constitute the final remedy for OU1, the statutory preference for remedies that employ treatment that reduces, toxicity, mobility, or volume as a principle element will be addressed by the final response action.

14.6 Five-Year Review Requirements

Since this remedy will result in hazardous substances, pollutants, or contaminants remaining at OU1 above health-based levels that would allow for unlimited use and unrestricted exposure, statutory reviews will be conducted every five-year reviews after the commencement of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment within five years after commencement of the interim remedial action.

15.0 Documentation of Significant Changes from Preferred Alternative of Proposed Plan

The Proposed Plan for Interim Action of OU1 was released for public comment in August 2007. The Proposed Plan for Interim Action of OU1 identified Alternative V – Alternate Water Supply/Treatment at Private Wellheads, Groundwater Monitoring, ICs, and Operation / Monitoring of Air Stripper, as the Preferred Alternative for OU1. The DNR reviewed all written and verbal comments submitted during the public comment period. It was determined that no significant changes to the remedy, as originally identified in the Proposed Plan for Interim Action of OU1, were necessary.

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Table 1-1: Summary of Operable Units Designations
Record of Decision for Interim Action for OU1
Oak Grove Village Well Site, OU1
Oak Grove Village, Missouri

Operable unit	Approximate area of investigation	Contamination summary
OU1	2 square miles including Oak Grove Village, parts of Sullivan and, unincorporated areas	- Known TCE use and disposal - TCE/PCE in soils below EPA guidelines - TCE and cis-DCE below MCLs in groundwater - Contaminated private, commercial and municipal wells in OU1
OU2	3 square miles including Oak Grove Village, parts of Sullivan and, unincorporated areas	- Landfill used for industrial and municipal waste disposal (1970-1983), currently in post closure - TCE and Freon™ in surface water and cave air below guidelines - TCE above MCL &MWQSs in groundwater - TCE and Freon™ below MCLs, PRGs, & MWQSs in groundwater - Contaminated private, commercial and municipal wells in OU2

Notes:

[OU, Operable unit; TCE, trichloroethene; PCE, tetrachloroethene; EPA, U.S. Environmental Protection Agency; MCL, maximum contaminant level; PRG, preliminary remediation goals]

The division of the operable units can be found on Figure 1.

Table 6-1: Contaminants of Potential Concern and Contaminants of Concern for Groundwater Record of Decision for Interim Action for OU1 Oak Grove Village Well Site, OU1 Oak Grove Village, Missouri

Contaminants of Potential Concern and Contaminants of Concern[1,2]	CAS#
1,2,4-Trichlorobenzene	120-82-1
1,2-Dibromo-3-chloropropane	96-12-8
4-Methyl-2-pentanone (MIBK)	108-10-1
Acetone	67-64-1
Bromodichloromethane	75-27-4
Chloroform	67-66-3
cis-1,2-Dichloroethene	156-59-2
Methane	74-82-8
n-Butylbenzene	104-51-8
Toluene	108-88-3
Total THMs	NA
Tetrachloroethene (PCE)	127-18-4
Trichloroethene (TCE)	**79-01-6**
Trichlorofluoromethane (Freon-11)	75-69-4
Vinyl Chloride	75-01-4

Note:

1. Contaminants of Potential Concern and Contaminants of Concern list taken from Table 2 of the "Baseline Human Health Risk Assessment for the Oak Grove Village Well Site" prepared by the Missouri Department of Health and Senior Services (DHSS), June 2005. The list was modified based on information provided by DHSS after the completion of the Phase II RI/FS and for applicability for OU1.
2. Contaminants of Concern highlighted and **bold** on this table (Table 6-1).

Table 6-2: Summary of Contaminants of Potential Concern (COPCs) and Medium-Specific Exposure Point Concentrations (EPCs) Record of Decision for Interim Action for OU1 Oak Grove Village Well Site, OU1 Oak Grove Village, Missouri

Exposure Point Concentrations (EPCs) for the Highway AF Plume

Exposure Point (Well #)	COPCs	# of Samples	Average	Standard Deviation	Minimum Detected Value	Maximum Detected Value	EPCs	MCL	Units
PW023	TCE	12	2.74	0.87	1.79	4.9	2.74	5.00	µg/l
PH039	1,2,4-Trichlorobenzene	1	na	na	0.36	0.36	0.36	70.00	µg/l
PH039	1,2-Dibromo-3-chloropropane	1	na	na	0.23	0.23	0.23	0.20	µg/l
PH039	n-Butylbenzene	1	na	na	0.22	0.22	0.22	NA	µg/l
PH006	Trichlorofluoromethane (Freon-11)	5	0.81	1.13	0.24	2.5	0.81	NA	µg/l
PW027	Chloroform	8	0.29	0.12	0.25	0.58	0.29	80.00	µg/l
PW067	Methane	1	na	na	0.13	0.13	0.13	NA	µg/l

Exposure Point Concentrations (EPCs) for COS09 and COS10

Exposure Point (Well #)	COPCs	# of Samples	Average	Standard Deviation	Minimum Detected Value	Maximum Detected Value	EPCs	MCL	Units
COS09	TCE	15	2.45	1.23	0.60	4.00	2.45	5.00	µg/l
COS09	Trichlorofluoromethane (Freon-11)	4	0.81	1.13	0.25	2.50	0.81	NA	µg/l
COS10	TCE	8	0.63	1.08	0.25	3.30	0.63	5.00	µg/l

Exposure Point Concentrations (EPCs) for TRW Plume

Exposure Point (Well #)	COPCs	# of Samples	Average	Standard Deviation	Minimum Detected Value	Maximum Detected Value	EPCs	MCL	Units
OGV01	1,2,4-Trichlorobenzene	37	0.48	0.51	0.25	0.37	0.48	70.00	µg/l
OGV01	1,2-Dibromo-3-chloropropane	21	0.27	0.08	0.20	0.50	0.27	0.20	µg/l
OGV01	Acetone	18	6.39	3.76	2.50	10.00	6.39	NA	µg/l
OGV01	cis-1,2-Dichloroethene	37	0.70	0.66	0.21	37.00	0.70	70.00	µg/l
OGV01	n-Butylbenzene	28	0.33	0.12	0.20	28.00	0.33	NA	µg/l
COS02	Bromodichloromethane	9	0.28	0.08	0.25	0.50	0.28	80.00	µg/l
COS02	Chloroform	9	0.50	0.65	0.25	2.23	0.50	80.00	µg/l
COS02	Total THM	8	0.50	0.70	0.25	2.23	0.50	80.00	µg/l
COS02	Trichlorofluoromethane (Freon-11)	9	0.52	0.74	0.25	2.50	0.52	NA	µg/l
COS02	Vinyl Chloride	9	0.30	0.10	0.25	0.50	0.30	2.00	µg/l
OGV02	Toluene	15	0.76	1.69	0.25	6.85	0.76	1000.00	µg/l
OGV02	TCE	15	53.42	25.64	5.86	103.00	53.42	5.00	µg/l
COS03	4-Methyl-2-pentanone (MIBK)	2	1.77	1.79	0.50	3.03	1.77	NA	µg/l

Average = Average of detected values (1/2 of the Detection Limit used for samples where value was < Detection Limit).
NA = Not Available

Table 6-3: Cancer Toxicity Data Summary
Record of Decision for Interim Action for OU1
Oak Grove Village Well Site, OU1
Oak Grove Village, Missouri

Pathway	Chemical of Potential Concern (COPC)	Weight of Evidence/Cancer Guideline Description	Oral Cancer Slope Factor SFo $(mg/kg\text{-}D)^{-1}$	Oral-to-dermal Extrapolation OAE (unitless)	Dermal Cancer Slope Factor SFd $(mg/kg\text{-}D)^{-1}$	Inhalation Unit Risks URi $(mg/m^3)^{-1}$	Inhalation Cancer Slope Factor SFi $(mg/kg\text{-}D)^{-1}$	Target Organ / System	Source
GW	1,2,4-Trichlorobenzene	D	NA	NA	NA	NA	NA	NA	NA
GW	1,2-Dibromo-3-chloropropane	2B: The agent is possibly carcinogenic to humans	7.00E+00 (C)	NA	NA	1.90E+00 (C)	6.65E+00	Stomach, Liver, & Kidney	C
GW	4-Methyl-2-pentanone (MIBK)	NA	NA	NA	NA	NA	NA	NA	NA
GW	Acetone	NA	NA	NA	NA	NA	NA	NA	NA
GW	Bromodichloromethane	B2	6.20E-02 (I)	NA	NA	3.70E-02 (C)	1.30E-01	Kidney	I/C
GW	Chloroform	B2	See comment #1 below (I)	NA	NA	2.30E-02 (I)	8.05E-02	Liver	I
GW	cis-1,2-Dichloroethene	D	NA	NA	NA	NA	NA	NA	NA
GW	Methane	NA	NA	NA	NA	NA	NA	NA	NA
GW	n-Butylbenzene	NA	NA	NA	NA	NA	NA	NA	NA
GW	Toluene	D	NA	NA	NA	NA	NA	NA	NA
GW	Total THMs	NA	NA	NA	NA	NA	NA	NA	NA
GW	Tetrachloroethene (PCE)	Not assessed under IRIS; however, under EPA's current (1986) cancer guidelines, PCE would be classified as a "probable human carcinogen" (Group B2).	5.40E-01 (C)	1 (E)	5.40E-01	5.90E-03 (C)	2.07E-02	Respiratory Tract, Cervix, & Skin	C/E/C
GW	Trichloroethene (TCE) (draft)	Not assessed under IRIS; however, under EPA's current (1986) cancer guidelines, TCE would be classified as a "probable human carcinogen" (Group B1).	4.00E-01 (N)	1 (E)	4.00E-01	NA	4.00E-01 (route extrapolation)	Liver	N/E
GW	Trichloroethene (TCE) (provisional)	Under EPA's proposed (1996, 1999) cancer guidelines, TCE can be characterized as a "highly likely to produce cancer in humans."	1.10E-02 (N)	1 (E)	1.10E-02	1.70E-03 (N)	5.95E-03	Liver	N/E/N
GW	Trichlorofluoromethane (Freon-11)	NA	NA	NA	NA	NA	NA	NA	NA

GW	Vinyl Chloride-Continuous lifetime exposure during adulthood	A	7.20E-01 (I)	NA	NA	4.40E-03 (I)	1.54E-02	Liver	I
GW	Vinyl Chloride-Continuous lifetime exposure from birth	A	1.50E+00 (I)	NA	NA	8.80E-03 (I)	3.08E-02	Liver	I

Comments:

#1 – The Agency has also chosen not to rely on a mathematical model to estimate a point of departure for cancer risk estimate, because the mode of action indicates that cytotoxicity is the critical effect and the reference dose value is considered protective for this effect. A dose of 0.01 mg/kg/day (equal to the RfD) can be considered protective against cancer risk (see IRIS).

NA · Not Available/Not Applicable

Carcinogenic Toxicity Values

Weight of Evidence Classifications

A – Human Carcinogen, based on sufficient evidence from epidemiological studies
B1 – Probable Human Carcinogen, based on sufficient evidence from animal studies and limited evidence from epidemiological studies
B2 - Probable Human Carcinogen, based on sufficient evidence from animal studies, but inadequate epidemiological data
C – Possible Human Carcinogen
D – Not Classifiable as to Human Carcinogenicity

Source References

I – EPA's Integrated Risk Assessment System (IRIS), October 2004
P – EPA's Provisional Peer Reviewed Toxicity Database (PPRTVs), October 2004
N – National Center for Environmental Assessment (NCEA)
C – California Environmental Protection Agency (CalEPA), October 2004
A – ATSDR Minimal Risk Levels (MRLs), January 2004
H – EPA's Health Effects Assessment Summary Tables (HEAST), 1997
R – EPA Region 9 PRG Table, October 2004
E – EPA RAGS, Part E: Supplemental Guidance for Dermal Risk Assessment

Table 6-4: Non-Carcinogenic Toxicity Values
Record of Decision for Interim Action for OU1
Oak Grove Village Well Site, OU1
Oak Grove Village, Missouri

Pathway	Chemical of Potential Concern (COPC)	Oral Reference Doses RfDo (mg/kg-D)	Oral-to-dermal Extrapolation OAE (unitless)	Dermal Reference Doses RfDd (mg/kg-D)	Reference Concentrations RfC (mg/m^3)	Inhalation Reference Doses RfDi (mg/kg-D)	Sources	Effects of Concern
GW	1,2,4-Trichlorobenzene	1.00E-02 (I)	1 (E)	1.00E-02	2.00E-01 (H)	5.71E-02	I/E/H	Increased adrenal weights, vacuolization of zona fasciculata in the cortex
GW	1,2-Dibromo-3-chloropropane	NA	NA	NA	2.00E-04 (I)	5.71E-05	I	Testicular effects
GW	4-Methyl-2-pentanone (MIBK)	8.00E-02 (H)	NA	NA	3.00E+00 (I)	8.57E-01	H/I	Reduced fetal body weight, skeletal variations, & increased fetal death in mice, & skeletal variations in rats
GW	Acetone	9.00E-01 (I)	NA	NA	3.09E+01 (A)	8.83E+00	I/A	Nephropathy
GW	Bromodichloromethane	2.00E-02 (I)	NA	NA	NA	2.00E-02 (route extrapolation)	I	Renal cytomegaly
GW	Chloroform	1.00E-02 (I)	NA	NA	3.00E-01 (C)	8.57E-02	I/C	Moderate/marked fatty cyst formation in the liver and elevated SGPT
GW	cis-1,2-Dichloroethene	1.00E-02 (P)	NA	NA	NA	1.00E-02 (route extrapolation)	P	Blood effects
GW	Methane	NA	NA	NA	NA	NA	NA	NA
GW	n-Butylbenzene	4.00E-02 (R)	NA	NA	NA	4.00E-02 (route extrapolation)	R	CNS depression, headache, anorexia, muscular weakness, incoordination, nausea, vertigo, paresthesia, mental confusion, and unconsciousness
GW	Toluene	2.00E-01 (I)	1 (E)	2.00E-01	4.00E-01 (I)	1.14E-01	I/E/I	Changes in liver & kidney weights & degeneration of nasal epithelium & neurological effects when inhaled
GW	Total THMs	NA	NA	NA	NA	NA	NA	NA
GW	Tetrachloroethene (PCE)	1.00E-02 (I)	1 (E)	1.00E-02	6.00E-01 (N)	1.71E-01	I/E/N	Hepatotoxicity
GW	Trichloroethene (TCE) (draft)	3.00E-04 (N)	1 (E)	3.00E-04	4.00E-02 (N)	1.14E-02	N/E/N	Liver and kidney effects
GW	Trichloroethene (TCE) (provisional)	6.00E-03 (N)	1 (E)	6.00E-03	NA	NA	N/E	Liver and kidney effects
GW	Trichlorofluoromethane (Freon-11)	3.00E-01 (I)	1 (E)	3.00E-01	7.00E-01 (H)	2.00E-01	I/E/H	Liver effects
GW	Vinyl Chloride-Continuous	3.00E-03 (I)	NA	NA	1.00E-01 (I)	2.86E-02	I	Liver cell polymorphism

	lifetime exposure during adulthood							
GW	Vinyl Chloride-Continuous lifetime exposure from birth	3.00E-03 (I)	NA	NA	1.00E-01 (I)	2.86E-02	I	Liver cell polymorphism

Comments:

NA – Not Available/Not Applicable

Source References

I – EPA's Integrated Risk Assessment System (IRIS), October 2004
P – EPA's Provisional Peer Reviewed Toxicity Database (PPRTVs), October 2004
N – National Center for Environmental Assessment (NCEA)
C – California Environmental Protection Agency (CalEPA), October 2004
A – ATSDR Minimal Risk Levels (MRLs), January 2004
H – EPA's Health Effects Assessment Summary Tables (HEAST), 1997
R – EPA Region 9 PRG Table, October 2004
E – EPA RAGS, Part E: Supplemental Guidance for Dermal Risk Assessment

Table 6-5A: Risk Characterization Summary - Carcinogens
Record of Decision for Interim Action for OU1
Oak Grove Village Well Site, OU1
Oak Grove Village, Missouri

Carcinogenic Risks Calculated for Future Residential Exposure to Contamination in Groundwater - Highway AF Plume

Contaminants of Potential Concern (COPCs)	**Drinking Water Ingestion**	**Dermal Contact**	**Inhalation**	
1,2,4-Trichlorobenzene	NA	NA	NA	
1,2-Dibromo-3-chloropropane	2.4E-05	NA	1.1E-04	
Chloroform	See comment #1 below	See comment #1 below	1.7E-06	
Methane	NA	NA	NA	
n-Butylbenzene	NA	NA	NA	
Trichloroethene (TCE) (draft)	1.6E-05	1.4E-06	8.1E-05	
Trichloroethene (TCE) (provisional)	4.5E-07	3.8E-08	1.2E-06	
Trichlorofluoromethane (Freon-11)	NA	NA	NA	
	Pathway	**Carcinogenic**	**Risks**	**Total Carcinogenic Risk for Future Residential Scenarios**
Total Risk including TCE (provisional)	2.4E-05	3.8E-08	1.1E-04	**1.4E-04**
Total Risk including TCE (draft)	4.0E-05	1.4E-06	2.0E-04	**2.4E-04**

Comments:

#1 – The Agency has chosen not to rely on a mathematical model to estimate a point of departure for cancer risk estimate, because the mode of action indicates that cytotoxicity is the critical effect and the reference dose value is considered protective fort his effect. A dose of 0.01 mg/kg/day (equal to the RfD) can be considered protective against cancer risk (see IRIS). A dose of 4.33E-06 was calculated for the residential scenario, which is well below the aforementioned dose of concern.

NA = Not Available – lacks toxicity values

Carcinogenic Risks Calculated for Future Residential Exposure to Contamination in Groundwater – COS09

Contaminants of Potential Concern (COPCs)	Drinking Water Ingestion	Dermal Contact	Inhalation	
Trichloroethene (TCE) (draft)	1.5E-05	7.0E-07	7.3E-05	
Trichloroethene (TCE) (provisional)	4.0E-07	1.9E-08	1.1E-06	
Trichlorofluoromethane (Freon-11)	NA	NA	NA	
	Pathway	**Carcinogenic**	**Risks**	**Total Carcinogenic Risk for Future Residential Scenarios**
Total Risk including TCE (provisional)	4.0E-07	1.9E-08	1.1E-06	**1.5E-06**
Total Risk including TCE (draft)	1.5E-05	7.0E-07	7.3E-05	**8.8E-05**

Comments:

NA = Not Available – lacks toxicity values

Carcinogenic Risks Calculated for Future Residential Exposure to Contamination in Groundwater – COS10

Contaminants of Potential Concern (COPCs)	Drinking Water Ingestion	Dermal Contact	Inhalation	
Trichloroethene (TCE) (draft)	3.8E-06	7.0E-07	1.9E-05	
Trichloroethene (TCE) (provisional)	1.0E-07	1.9E-08	2.8E-07	
	Pathway	**Carcinogenic**	**Risks**	**Total Carcinogenic Risk for Future Residential Scenarios**
Total Risk including TCE (provisional)	1.0E-07	1.9E-08	2.8E-07	**4.0E-07**
Total Risk including TCE (draft)	3.8E-06	7.0E-07	1.9E-05	**2.3E-05**

Comments:

NA = Not Available – lacks toxicity values

Carcinogenic Risks Calculated for Future Residential Exposure to Contamination in Groundwater – TRW Plume

Contaminants of Potential Concern (COPCs)	Drinking Water Ingestion	Dermal Contact	Inhalation	
1,2,4-Trichlorobenzene	NA	NA	NA	
1,2-Dibromo-3-chloropropane	2.8E-05	NA	1.3E-04	
4-Methyl-2-pentanone (MIBK)	NA	NA	NA	
Acetone	NA	NA	NA	
Bromodichloromethane	2.6E-07	NA	2.7E-06	
Chloroform	See comment #1 below	See comment #1 below	3.0E-06	
cis-1,2-Dichloroethene	NA	NA	NA	
n-Butylbenzene	NA	NA	NA	
Toluene	NA	NA	NA	
Total THMs	NA	NA	NA	
Trichloroethene (TCE) (draft)	3.2E-04	2.7E-05	1.6E-03	
Trichloroethene (TCE) (provisional)	8.7E-06	7.5E-07	2.4E-05	
Trichlorofluoromethane (Freon-11)	NA	NA	NA	
Vinyl Chloride – Continuous lifetime exposure from birth	6.7E-06	NA	6.9E-07	
	Pathway Carcinogenic Risks			**Total Carcinogenic Risk for Future Residential Scenarios**
Total Risk including TCE (provisional)	4.4E-05	7.5E-07	1.6E-04	**2.1E-04**
Total Risk including TCE (draft)	3.5E-04	2.7E-05	1.7E-03	**2.1E-03**

Comments:

#1 – The Agency has chosen not to rely on a mathematical model to estimate a point of departure for cancer risk estimate, because the mode of action indicates that cytotoxicity is the critical effect and the reference dose value is considered protective fort his effect. A dose of 0.01 mg/kg/day (equal to the RfD) can be considered protective against cancer risk (see IRIS). A dose of 7.40E-06 was calculated for the residential scenario, which is well below the aforementioned dose of concern.

NA = Not Available – lacks toxicity values

Table 6-5B: Risk Characterization Summary - Carcinogens
Record of Decision for Interim Action for OU1
Oak Grove Village Well Site, OU1
Oak Grove Village, Missouri

Carcinogenic Risks Calculated for Future Commercial/Industrial Exposure to Contamination in Groundwater - Highway AF Plume

Contaminants of Potential Concern (COPCs)	Drinking Water Ingestion	Dermal Contact	Inhalation	
1,2,4-Trichlorobenzene	NA	NA	NA	
1,2-Dibromo-3-chloropropane	5.6E-06	NA	8.1E-05	
Chloroform	See comment #1 below	See comment #1 below	8.0E-07	
Methane	NA	NA	NA	
n-Butylbenzene	NA	NA	NA	
Trichloroethene (TCE) (draft)	3.8E-06	6.6E-07	3.7E-05	
Trichloroethene (TCE) (provisional)	1.1E-07	1.8E-08	5.5E-07	
Trichlorofluoromethane (Freon-11)	NA	NA	NA	
	Pathway	**Carcinogenic**	**Risks**	**Total Carcinogenic Risk for Future Commercial/Industrial Scenarios**
Total Risk including TCE (provisional)	5.7E-06	1.8E-08	8.3E-05	**8.8E-05**
Total Risk including TCE (draft)	9.5E-06	6.6E-07	1.2E-04	**1.3E-04**

Comments:

#1 – The Agency has chosen not to rely on a mathematical model to estimate a point of departure for cancer risk estimate, because the mode of action indicates that cytotoxicity is the critical effect and the reference dose value is considered protective fort his effect. A dose of 0.01 mg/kg/day (equal to the RfD) can be considered protective against cancer risk (see IRIS). A dose of 1.02E-06 was calculated for the commercial / industrial scenario, which is well below the aforementioned dose of concern.

NA = Not Available – lacks toxicity values

Carcinogenic Risks Calculated for Future Commercial/Industrial Exposure to Contamination in Groundwater – COS09

Contaminants of Potential Concern (COPCs)	Drinking Water Ingestion	Dermal Contact	Inhalation	
Trichloroethene (TCE) (draft)	3.4E-06	5.9E-07	3.3E-05	
Trichloroethene (TCE) (provisional)	9.4E-08	1.6E-08	4.9E-07	
Trichlorofluoromethane (Freon-11)	NA	NA	NA	
	Pathway	Carcinogenic	Risks	**Total Carcinogenic Risk for Future Commercial/Industrial Scenarios**
Total Risk including TCE (provisional)	9.4E-08	1.6E-08	4.9E-07	**6.0E-07**
Total Risk including TCE (draft)	3.4E-06	5.9E-07	3.3E-05	**3.7E-05**

Comments:

NA = Not Available – lacks toxicity values

Carcinogenic Risks Calculated for Future Commercial/Industrial Exposure to Contamination in Groundwater – COS10

Contaminants of Potential Concern (COPCs)	Drinking Water Ingestion	Dermal Contact	Inhalation	
Trichloroethene (TCE) (draft)	8.8E-07	5.9E-07	8.6E-06	
Trichloroethene (TCE) (provisional)	2.4E-08	1.6E-08	1.3E-07	
	Pathway	Carcinogenic	Risks	**Total Carcinogenic Risk for Future Commercial/Industrial Scenarios**
Total Risk including TCE (provisional)	2.4E-08	1.6E-08	1.3E-07	**1.7E-07**
Total Risk including TCE (draft)	8.8E-07	5.9E-07	8.6E-06	**1.0E-05**

Comments:

NA = Not Available – lacks toxicity values

Carcinogenic Risks Calculated for Future Commercial/Industrial Exposure to Contamination in Groundwater – TRW Plume

Contaminants of Potential Concern (COPCs)	Drinking Water Ingestion	Dermal Contact	Inhalation	
1,2,4-Trichlorobenzene	NA	NA	NA	
1,2-Dibromo-3-chloropropane	6.6E-06	NA	6.1E-05	
4-Methyl-2-pentanone (MIBK)	NA	NA	NA	
Acetone	NA	NA	NA	
Bromodichloromethane	6.1E-08	NA	1.2E-06	
Chloroform	See comment #1 below	See comment #1 below	1.4E-06	
cis-1,2-Dichloroethene	NA	NA	NA	
n-Butylbenzene	NA	NA	NA	
Toluene	NA	NA	NA	
Total THMs	NA	NA	NA	
Trichloroethene (TCE) (draft)	7.5E-05	1.3E-05	7.2E-04	
Trichloroethene (TCE) (provisional)	2.1E-06	3.6E-07	1.1E-05	
Trichlorofluoromethane (Freon-11)	NA	NA	NA	
Vinyl Chloride – Continuous lifetime exposure from birth	7.5E-07	NA	1.6E-07	
	Pathway	**Carcinogenic**	**Risks**	**Total Carcinogenic Risk for Future Commercial/Industrial Scenarios**
Total Risk including TCE (provisional)	9.5E-06	3.6E-07	7.5E-05	**8.5E-05**
Total Risk including TCE (draft)	8.2E-05	1.3E-05	7.9E-04	**8.8E-04**

Comments:

#1 – The Agency has chosen not to rely on a mathematical model to estimate a point of departure for cancer risk estimate, because the mode of action indicates that cytotoxicity is the critical effect and the reference dose value is considered protective fort his effect. A dose of 0.01 mg/kg/day (equal to the RfD) can be considered protective against cancer risk (see IRIS). A dose of 1.74E-06 was calculated for the commercial / industrial scenario, which is well below the aforementioned dose of concern.

NA = Not Available – lacks toxicity values

Table 6-6A: Risk Characterization Summary – Non-Carcinogenic
Record of Decision for Interim Action for OU1
Oak Grove Village Well Site, OU1
Oak Grove Village, Missouri

Non-Carcinogenic Risks Calculated for Future Residential Exposure to Contamination in Groundwater - Highway AF Plume

Contaminants of Potential Concern (COPCs)	Drinking Water Ingestion	Dermal Contact	Inhalation	
1,2,4-Trichlorobenzene	1.2E-03	8.1E-04	1.1E-03	
1,2-Dibromo-3-chloropropane	NA	NA	7.0E-01	
Chloroform	1.0E-03	NA	5.9E-04	
Methane	NA	NA	NA	
n-Butylbenzene	1.9E-04	NA	9.5E-04	
Trichloroethene (TCE) (draft)	3.2E-01	2.7E-02	4.2E-02	
Trichloroethene (TCE) (provisional)	1.6E-02	1.4E-03	NA	
Trichlorofluoromethane (Freon-11)	9.4E-05	9.0E-06	7.0E-04	
	Pathway	**Hazard**	**Indices**	**Total Hazard Index for Future Residential Scenarios**
Total Risk including TCE (provisional)	0.02	0.002	0.7	**0.7**
Total Risk including TCE (draft)	0.3	0.03	0.7	**1.1**

Comments:

NA = Not Available – lacks toxicity values

Non-Carcinogenic Risks Calculated for Future Residential Exposure to Contamination in Groundwater – COS09

Contaminants of Potential Concern (COPCs)	Drinking Water Ingestion	Dermal Contact	Inhalation	
Trichloroethene (TCE) (draft)	2.8E-01	1.4E-02	3.7E-02	
Trichloroethene (TCE) (provisional)	1.4E-02	6.8E-04	NA	
Trichlorofluoromethane (Freon-11)	9.4E-05	5.1E-06	7.0E-04	
	Pathway	**Hazard**	**Indices**	**Total Hazard Index for Future Residential Scenarios**
Total Risk including TCE (provisional)	0.01	0.001	0.001	**0.02**
Total Risk including TCE (draft)	0.3	0.01	0.04	**0.3**

Comments:

NA = Not Available – lacks toxicity values

Non-Carcinogenic Risks Calculated for Future Residential Exposure to Contamination in Groundwater – COS10

Contaminants of Potential Concern (COPCs)	Drinking Water Ingestion	Dermal Contact	Inhalation	
Trichloroethene (TCE) (draft)	7.3E-02	1.4E-02	3.7E-02	
Trichloroethene (TCE) (provisional)	3.6E-03	6.8E-04	NA	
	Pathway	**Hazard**	Indices	**Total Hazard Index for Future Residential Scenarios**
Total Risk including TCE (provisional)	0.004	0.001	NA	**0.004**
Total Risk including TCE (draft)	0.07	0.01	0.04	**0.1**

Comments:

NA = Not Available – lacks toxicity values

Non-Carcinogenic Risks Calculated for Future Residential Exposure to Contamination in Groundwater – TRW Plume

Contaminants of Potential Concern (COPCs)	Drinking Water Ingestion	Dermal Contact	Inhalation	
1,2,4-Trichlorobenzene	1.7E-03	1.1E-03	1.5E-03	
1,2-Dibromo-3-chloropropane	NA	NA	8.2E-01	
4-Methyl-2-pentanone (MIBK)	7.7E-04	NA	3.6E-04	
Acetone	2.5E-04	NA	NA	
Bromodichloromethane	4.9E-04	NA	2.4E-03	
Chloroform	1.7E-03	NA	1.0E-03	
cis-1,2-Dichloroethene	2.4E-03	NA	1.2E-02	
n-Butylbenzene	2.9E-04	NA	1.4E-03	
Toluene	1.3E-04	3.0E-05	1.2E-03	
Total THMs	NA	NA	NA	
Trichloroethene (TCE) (draft)	6.2E+00	5.3E-01	8.1E-01	
Trichloroethene (TCE) (provisional)	3.1E-01	5.3E-01	NA	
Trichlorofluoromethane (Freon-11)	6.0E-05	5.8E-06	4.5E-04	
Vinyl Chloride – Continuous lifetime exposure from birth	3.5E-03	NA	1.8E-03	
	Pathway	**Hazard**	**Indices**	**Total Hazard Index for Future Residential Scenarios**
Total Risk including TCE (provisional)	0.3	0.5	0.8	**2**
Total Risk including TCE (draft)	6.2	0.5	1.7	**8**

Comments:

NA = Not Available – lacks toxicity values

Table 6-6B: Risk Characterization Summary – Non-Carcinogenic
Record of Decision for Interim Action for OU1
Oak Grove Village Well Site, OU1
Oak Grove Village, Missouri

Non-Carcinogenic Risks Calculated for Future Commercial/Industrial Exposure to Contamination in Groundwater - Highway AF Plume

Contaminants of Potential Concern (COPCs)	Drinking Water Ingestion	Dermal Contact	Inhalation	
1,2,4-Trichlorobenzene	3.5E-04	4.6E-04	6.0E-04	
1,2-Dibromo-3-chloropropane	NA	NA	3.8E-01	
Chloroform	2.8E-04	NA	3.2E-04	
Methane	NA	NA	NA	
n-Butylbenzene	5.4E-05	NA	5.2E-04	
Trichloroethene (TCE) (draft)	8.9E-02	1.5E-02	2.3E-02	
Trichloroethene (TCE) (provisional)	4.5E-03	7.7E-04	NA	
Trichlorofluoromethane (Freon-11)	2.6E-05	2.9E-06	3.8E-04	
	Pathway	**Hazard**	**Indices**	**Total Hazard Index for Future Commercial/Industrial Scenarios**
Total Risk including TCE (provisional)	0.005	0.001	0.384	**0.4**
Total Risk including TCE (draft)	0.09	0.02	0.407	**0.5**

Comments:

NA = Not Available – lacks toxicity values

Non-Carcinogenic Risks Calculated for Future Commercial/Industrial Exposure to Contamination in Groundwater – COS09

Contaminants of Potential Concern (COPCs)	Drinking Water Ingestion	Dermal Contact	Inhalation	
Trichloroethene (TCE) (draft)	8.0E-02	1.4E-02	2.0E-02	
Trichloroethene (TCE) (provisional)	4.0E-03	6.9E-04	NA	
Trichlorofluoromethane (Freon-11)	2.6E-05	5.2E-06	3.8E-04	
	Pathway	**Hazard**	**Indices**	**Total Hazard Index for Future Commercial/Industrial Scenarios**
Total Risk including TCE (provisional)	0.004	0.001	0.0004	**0.005**
Total Risk including TCE (draft)	0.1	0.01	0.02	**0.1**

Comments:

NA = Not Available – lacks toxicity values

Non-Carcinogenic Risks Calculated for Future Commercial/Industrial Exposure to Contamination in Groundwater – COS10

Contaminants of Potential Concern (COPCs)	Drinking Water Ingestion	Dermal Contact	Inhalation	
Trichloroethene (TCE) (draft)	2.1E-02	1.4E-02	5.2E-03	
Trichloroethene (TCE) (provisional)	1.0E-03	6.9E-04	NA	
	Pathway	**Hazard**	**Indices**	**Total Hazard Index for Future Commercial/Industrial Scenarios**
Total Risk including TCE (provisional)	0.001	0.001	NA	**0.002**
Total Risk including TCE (draft)	0.02	0.01	0.005	**0.04**

Comments:

NA = Not Available – lacks toxicity values

Non-Carcinogenic Risks Calculated for Future Commercial/Industrial Exposure to Contamination in Groundwater – TRW Plume

Contaminants of Potential Concern (COPCs)	Drinking Water Ingestion	Dermal Contact	Inhalation	
1,2,4-Trichlorobenzene	4.7E-04	6.2E-04	8.0E-04	
1,2-Dibromo-3-chloropropane	NA	NA	8.0E-01	
4-Methyl-2-pentanone (MIBK)	NA	NA	2.0E-04	
Acetone	6.9E-05	NA	NA	
Bromodichloromethane	1.4E-04	NA	1.3E-03	
Chloroform	4.9E-04	NA	5.5E-04	
cis-1,2-Dichloroethene	6.8E-04	NA	6.6E-03	
n-Butylbenzene	8.0E-05	NA	1.6E-03	
Toluene	3.7E-05	1.3E-05	6.3E-04	
Total THMs	NA	NA	NA	
Trichloroethene (TCE) (draft)	1.7E+00	3.0E-01	4.4E-01	
Trichloroethene (TCE) (provisional)	8.7E-02	1.5E-02	NA	
Trichlorofluoromethane (Freon-11)	1.7E-05	3.3E-06	2.5E-04	
Vinyl Chloride – Continuous lifetime exposure from birth	9.8E-04	NA	1.0E-03	
	Pathway	**Hazard**	**Indices**	**Total Hazard Index for Future Commercial/Industrial Scenarios**
Total Risk including TCE (provisional)	0.1	0.02	0.8	**0.9**
Total Risk including TCE (draft)	1.7	0.3	1.3	**3**

Comments:

NA = Not Available – lacks toxicity values

Table 7-1: Groundwater Cleanup Levels for Future Residential and Commercial/Industrial Exposure Scenarios Record of Decision for Interim Action for OU1 Oak Grove Village Well Site, OU1 Oak Grove Village, Missouri

Contaminant of Potential Concern and Contaminants of Concern[1]	CAS#	MO MCL[2] µg/l	MO WQS[3] µg/l	EPA MCL[4] µg/l	EPA MCLG[4] µg/l	PQL[5] µg/l	Carcinogenic Cleanup Level[6] µg/l	Non-Carcinogenic Cleanup Level[6] µg/l	Cleanup Level[7] µg/l
1,2,4-Trichlorobenzene	120-82-1	70	70	70	70	0.5		10	70
1,2 Dibromo-3-chloropropane	96-12-8	0.2		0.2	0.048	0.5	.002	.03	0.2
4-Methyl-2-pentanone (MIBK)	108-10-1					0.5		200	200
Acetone	67-64-1					0.5		2,000	2,000
Bromodichloromethane	75-27-4	80	100	80		0.5	0.1	10	80
Chloroform	67-66-3	80	100	80		0.5	10	20	80
cis-1,2-Dichloroethene	156-59-2	70	70	70	70	0.5		5	70
Methane	74-82-8					0.5			N.D.
n-Butylbenzene	104-51-8					0.5		20	20
Toluene	108-88-3	1,000	1,000	1,000	1.000	0.5		100	1,000
Total THMs	NA	80	100	80		0.5			80
Tetrachloroethene (PCE)	127-18-4	5	5	5	0	0.5	0.1	20	5
Trichloroethene (TCE) (provisional)	**79-01-6**	**5**	**5**	**5**	**0**	**0.5**	**2**	**10**	**5**
Trichlorofluoromethane (Freon™-11)	75-69-4					0.5		100	100
Vinyl Chloride	75-01-4	2	2	2	0	0.5	0.04	10	2

Notes:

1. Table taken from "Baseline Human Health Risk Assessment for the Oak Grove Village Well Site," DHSS, June 2005 and the Phase II "Feasibility Study" Benham Corporations, August 2005. The table was modified for the Post Phase II "Feasibility Study, Oak Grove Village Well Site, Oak Grove Village, Missouri" DNR, 2007.
2. State of Missouri Maximum Contaminant Levels for Public Drinking Water -10 CSR 60 Chapter 4.
3. State of Missouri Criteria for Protection of Groundwater Designated Use -10 CSR 20-7.031.
4. EPA Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs) -40 CFR 141.
5. Typical Practical Quantitation Level for VOCs -CLP analytical laboratory.
6. Risk-based Cleanup Levels for both carcinogens and non-carcinogenic effects taken from Appendix F of Baseline Human Health Risk Assessment for the Oak Grove Village Well Site, DHSS, June 2005. Carcinogenic cleanup levels chosen are based on 1×10^{-6} risk for residential exposures; non-carcinogenic cleanup levels based on THQ of 0.1 for residential exposures.
7. Cleanup level was determined based on the following methodology -1) the lower of the Missouri MCL, WQS, EPA MCL or non-zero MCLG; 2) If no MCL or WQS values exist, then the lower of the carcinogenic and non-carcinogenic cleanup levels; 3) If the results of steps 1 or 2 was less than the PQL, the PQL value was substituted.
8. Carcinogenic cleanup level based on 1×10^{-6} risk per chemical and non-carcinogenic cleanup level based on a Hazard Index rating of 0.1 per chemical. TCE cleanup levels are based on the EPA provisional toxicity values.
9. N.D.: Not determined. One contaminant of potential concern, methane, had no MCL or WQS values, nor were cleanup levels calculated by the DHSS due to an absence of toxicological data for risk assessment. Therefore, cleanup levels for this constituent were not determined.
10. The RG is highlighted and **bold** on this table (Table 7-1).

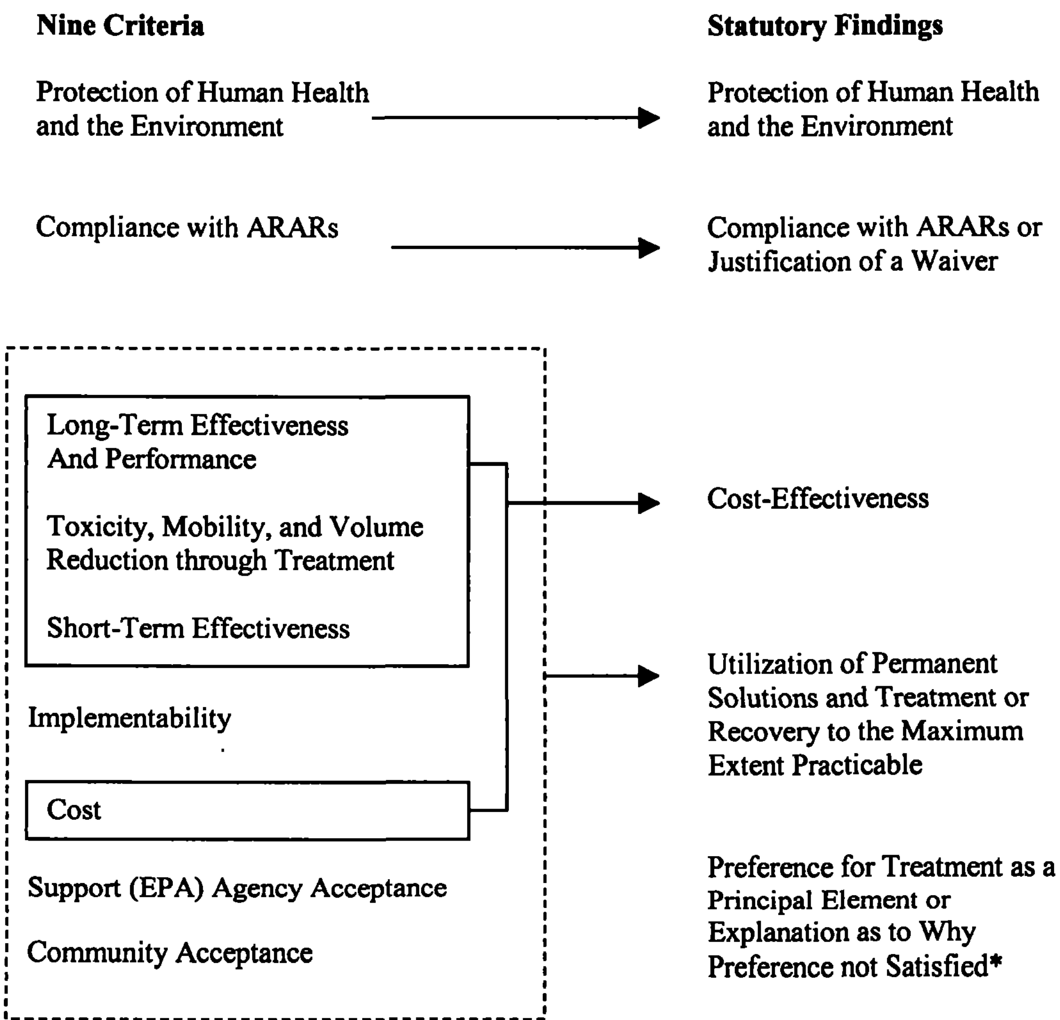
Table 10-1: Comparative Analysis of Remedial Action Alternatives
Record of Decision for Interim Action for OU1
Oak Grove Village Well Site, OU1
Oak Grove Village, Missouri

Criteria	Alternative I No Action	Alternative II Treatment at Private Wellheads and Groundwater Monitoring	Alternative III Alternate Water Supply/ Treatment at Private Wellheads and Groundwater Monitoring	Alternative IV Treatment at Private Wellheads, Groundwater Monitoring, and Operation / Monitoring of Air Stripper	Alternative V Alternate Water Supply / Treatment at Private Wellheads, Groundwater Monitoring, and Operation / Monitoring of Air Stripper
Overall Protection of Human Health and the Environment	No improvement in overall protection of human health and the environment from current conditions.	Provides protection for current and future receptors of groundwater that exceed RGs.	Provides protection for current and future receptors of groundwater that exceed RGs	Provides protection for current and future receptors of groundwater that exceed RGs	Provides protection for current and future receptors of groundwater that exceed RGs
Compliance with ARARs and TBCs.	Does not comply with all ARARs or TBCs.	Complies with all ARARs and TBCs.	Complies with all ARARs and TBCs.	Complies with all ARARs and TBCs.	Complies with all ARARs and TBCs.
Long-term Effectiveness and Permanence	Provides no long-term effective or permanent solution since no remedial action is implemented.	Carbon in treatment units must be changed at periodic intervals to maintain effectiveness.	Alternate water supply is a very effective and permanent source of water that meets RGs.	Carbon in treatment units must be changed at periodic intervals to maintain effectiveness.	Alternate water supply is a very effective and permanent source of water that meets RGs.
Reduction of Toxicity, Mobility or Volume Through Treatment	There would be no reduction of toxicity, mobility or volume through either treatment or containment.	The toxicity and volume of contamination in GW would be reduced through the use of treatment.	The toxicity and volume of contamination in GW would be reduced through the use of treatment.	The toxicity and volume of contamination in GW would be reduced through the use of treatment.	The toxicity and volume of contamination in GW would be reduced through the use of treatment.
Short-term Effectiveness	No short-term risks to community or workers.	There are no additional risks to the community, workers or the environment expected from this alternative.	Heavy construction work would be required for installation of water distribution lines; however, with proper precautions no additional risk is expected.	There are no additional risks to the community, workers or the environment expected from this alternative.	Heavy construction work would be required for installation of water distribution lines; however, with proper precautions no additional risk is expected.
Implementability	No implementation required.	Installation of carbon units considered easily implementable.	Installation of water distribution lines would require the necessary land access agreements, is considered easily implementable.	Installation of carbon units and considered easily implementable.	Installation of water distribution lines would require the necessary land access agreements, is considered easily implementable.
Capital Costs	$0	$39,703	$327,916	$39,703	$327,916
O&M Costs	$0	$1,353,000	$1,563,000	$1,454,010	$1,664,010
Periodic Costs	$300,000	$300,000	$300,000	$300,000	$300,000
Total Costs	$300,000	$1,692,703	$2,190,916	$1,793,713	$2,291,926
Present worth	$107,800	$707,149	$1,082,225	$748,930	$1,124,006
Support (EPA) Agency Acceptance	Not acceptable	Not acceptable	Not acceptable	Not acceptable	Preferred.
Community Acceptance	Not acceptable	Not acceptable	Not acceptable	Not acceptable	Preferred.

Table 10-2: Comparison of ARARs to Remedial Action Alternatives
Record of Decision for Interim Action for OU1
Oak Grove Village Well Site, OU1
Oak Grove Village, Missouri

Federal Regulation (Statute – Citation)	**Alternative I**	**Alternative II**	**Alternative III**	**Alternative IV**	**Alternative V**
National Primary Drinking Water Standards (Safe Drinking Water Act – 40 CFR 141, Subpart B)	Does not meet this ARAR, since no will be taken.	Meets ARAR by providing drinking water that meets standards.	Meets ARAR by providing drinking water that meets standards.	Meets ARAR by providing drinking water that meets standards.	Meets ARAR by providing drinking water that meets standards.
Occupational Health & Safety Act (OSHA Construction Standards – 29 CFR 1926; OSHA General Industry Standards 29 CFR 1910)	Does not meet this ARAR, since no will be taken.	Applicable. Workers implementing remedy will be required to follow these standards.	Applicable. Workers implementing remedy will be required to follow standards.	Applicable. Workers implementing remedy will be required to follow standards.	Applicable. Workers implementing remedy will be required to follow standards.
State Regulation (Statute – Citation)	**Alternative I**	**Alternative II**	**Alternative III**	**Alternative IV**	**Alternative V**
Drinking Water Regulations (MO Drinking Water Act – 40 RSMo Ch. 644, 10 CSR 60)	Does not meet this ARAR, since no will be taken.	Meets ARAR by providing drinking water that meets standards.	Meets ARAR by providing drinking water that meets standards.	Meets ARAR by providing drinking water that meets standards.	Meets ARAR by providing drinking water that meets standards.
Water Quality Standards (10 CSR 20 Ch. 7)	Does not meet this ARAR, since no will be taken.	Meets ARAR, since it establishes the classifications & standards for all waters of the state, including GW	Meets ARAR, since it establishes the classifications & standards for all waters of the state, including GW	Meets ARAR, since it establishes the classifications & standards for all waters of the state, including GW	Meets ARAR, since it establishes the classifications & standards for all waters of the state, including GW.
Cleanup Levels for Missouri (CALM) (10 CAR 25-15.0101, Rev.06/2001)	Does not meet this TBC, since no will be taken	Meets TBC by providing drinking water that meets standards	Meets TBC by providing drinking water that meets standards	Meets TBC by providing drinking water that meets standards	Meets TBC by providing drinking water that meets standards
Well Construction Rules (RSMo 256.600 to 256.64; 10 CSR 23-3.11 & 22-3.110)	Does not meet this ARAR, since no will be taken.	Meets ARAR, since applicable to all new and existing wells in OU1.	Meets ARAR, since applicable to all new and existing wells in OU1.	Meets ARAR, since applicable to all new and existing wells in OU1	Meets ARAR, since applicable to all new and existing wells in OU1

Table 14-1: Relationship of the Nine Criteria to the Statutory Findings
Record of Decision for Interim Action for OU1
Oak Grove Village Well Site, OU1
Oak Grove Village, Missouri

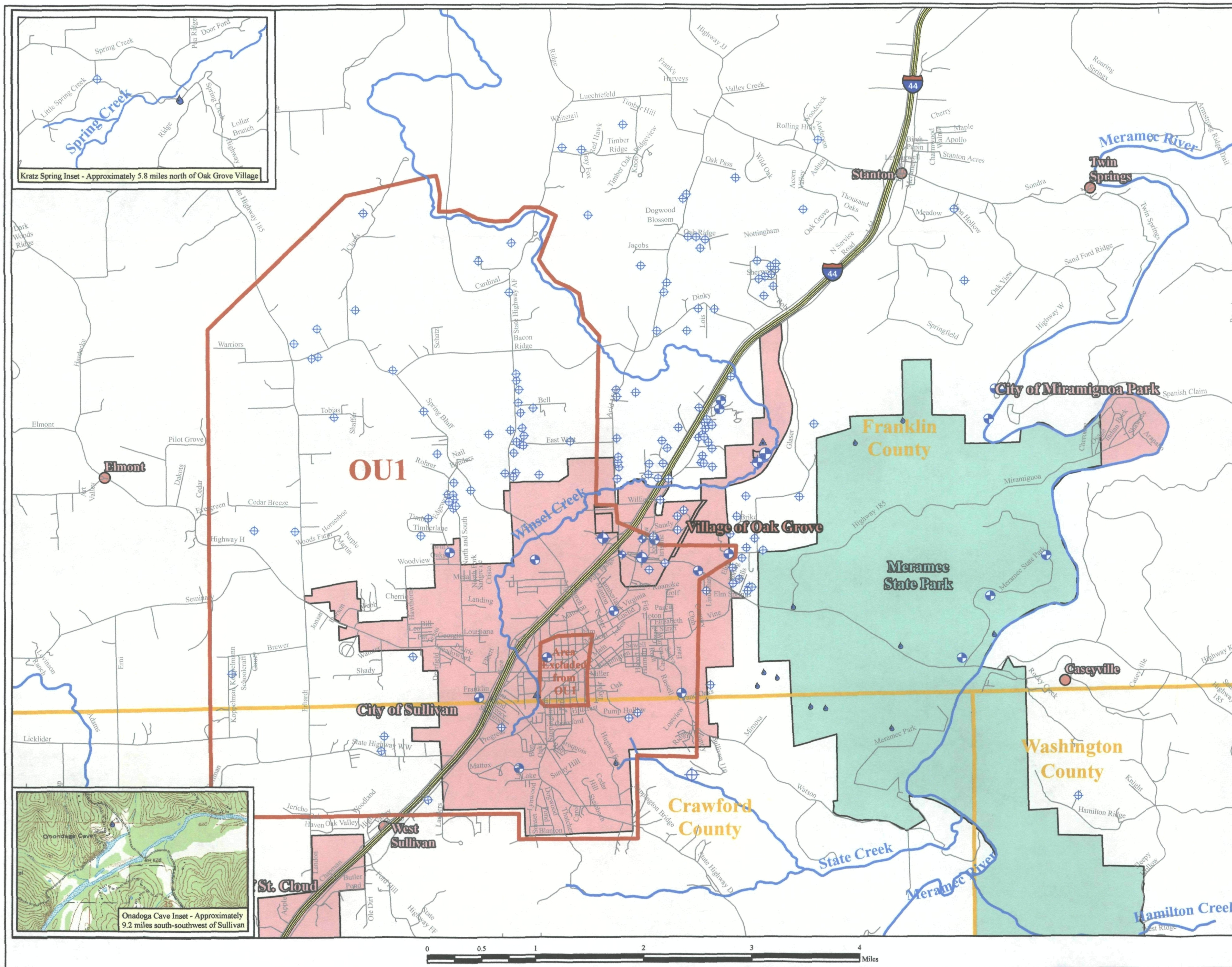


*Remedies which involve treatment of source materials constituting principal threat wastes likely will satisfy the statutory preference for treatment as a principal element, although this will not necessarily be true in all cases.

Table 14-2: Description of ARARs/TBCs for Selected Remedy
Record of Decision for Interim Action for OU1
Oak Grove Village Well Site, OU1
Oak Grove Village, Missouri

Authority	Medium	Requirement	Status	Synopsis of Requirement	Action to be Taken to Attain Requirement
Federal Regulatory Requirement	Groundwater	**National Primary Drinking Water Standards** (Safe Drinking Water Act – 40 CFR 141, Subpart B)	Applicable, Relevant and Appropriate.	Maximum Contaminant Levels (MCLs) are regulated for a number of organic contaminants. These levels regulate the concentrations of contaminants in public drinking water supplies and are considered relevant and appropriate for groundwater aquifers potentially used for drinking water.	The selected remedy will comply with these ARARs by providing drinking water that meets standards.
Federal Regulatory Requirement	Groundwater / Soil	**Occupational Health & Safety Act** (OSHA Construction Standards – 29 CFR 1926; OSHA General Industry Standards 29 CFR 1910)	Applicable, Relevant and Appropriate	These rules and standards are applicable, relevant and appropriate to workers implementing the selected remedy and will be required to follow standards.	The selected remedy will comply with these ARARs by providing a safe environment during all phases of implementation of the remedy.
State Regulatory Requirement	Groundwater	**Drinking Water Regulations** (MO Drinking Water Act – 40 RSMo Ch. 644, 10 CSR 60)	Applicable, Relevant and Appropriate	MCLs are regulated for organic contaminants for a number of organic contaminants. These levels regulate the concentrations of contaminants in public drinking water supplies and are considered relevant and appropriate for groundwater aquifers potentially used for drinking water.	The selected remedy will comply with these ARARs by providing drinking water that meets standards
State Regulatory Requirement	Groundwater	**Water Quality Standards** (10 CSR 20 Ch. 7)	Applicable, Relevant and Appropriate	MCLs are regulated for organic contaminants for a number of organic contaminants. These levels regulate the concentrations of contaminants in public drinking water supplies and are considered relevant and appropriate for groundwater aquifers potentially used for drinking water.	The selected remedy will comply with these ARARs by providing drinking water that meets standards.
State Regulatory Requirement	Groundwater	**Cleanup Levels for Missouri (CALM)** (10 CAR 25-15.0101, Rev.06/2001)	TBC	These requirements regulate actions by providing drinking water that meets cleanup standards for the state of Missouri.	The selected remedy will comply with these TBCs by providing drinking water that meets standards
State Regulatory Requirement	Groundwater / Soil	**Well Construction Rules** (RSMo 256.600 to 256.64; 10 CSR 23-3.11 & 22-3.110)	Applicable, Relevant and Appropriate	These rules are applicable, relevant and appropriate to all phases of construction associated with new and existing wells in OU1	The selected remedy will comply with these ARARs by following the appropriate requirements associated with all new and existing wells in OU1

Figure 1: Base Map and Drinking Water, Spring and Surface Water Sampling Map
Oak Grove Village Well Site
2000 - 2007



Legend

- Spring Sample
- Surface Water Sample
- Private Drinking Water Well Sample
- Monitoring Well Sample
- Public Drinking Water Well Sample
- Village
- Road
- Major River
- Interstate
- County Boundary
- Municipal Boundary
- MO DNR Land

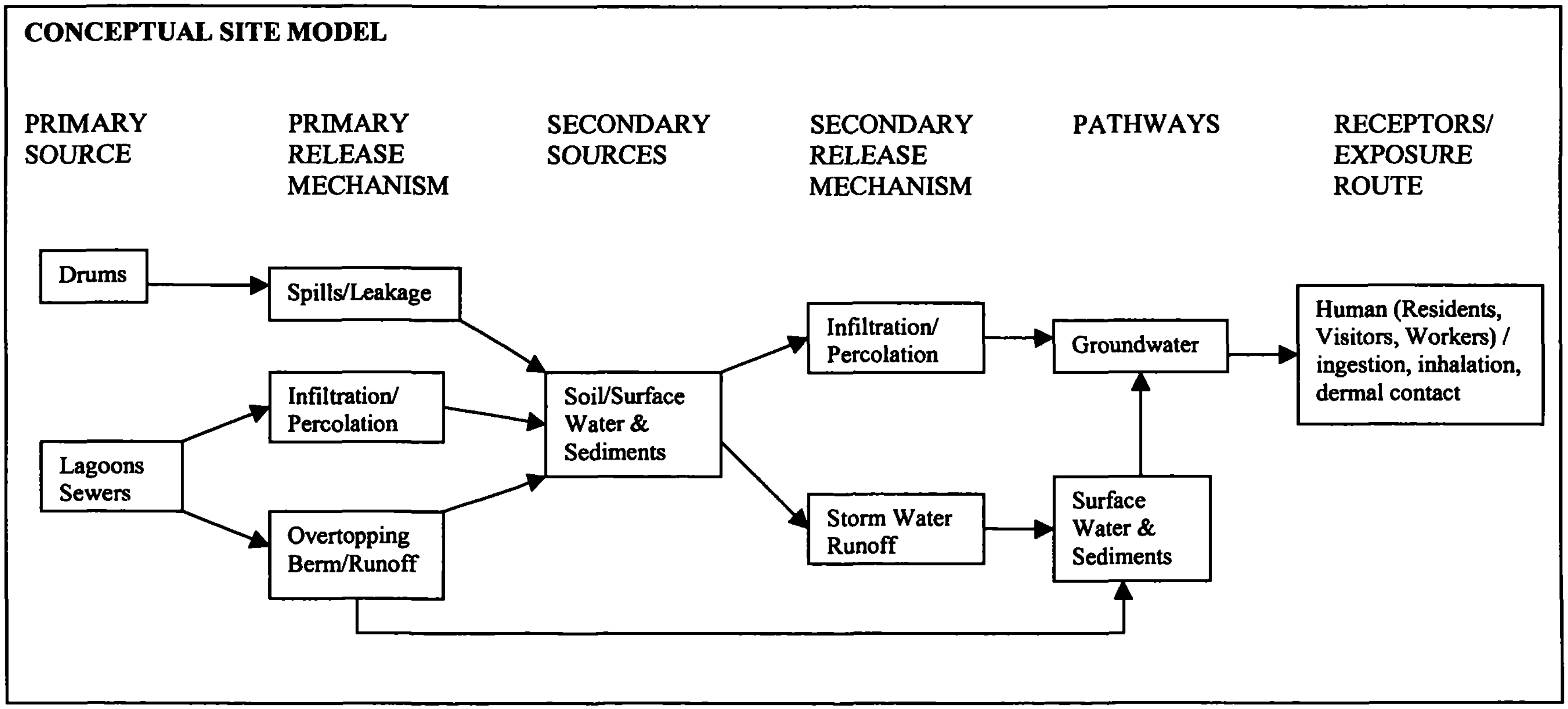
Map Created in March 2007 by Valerie Wilder

This map can be found at: M:\Superfund\Oak_Grove_Village\Water Sampling Map 11 x 17.mxd
Data Sources: Wellhead Protection, MoDNR Public Drinking Water Program.

Although data sets used to create this map have been compiled by the Missouri Department of Natural Resources, no warranty, expressed or implied, is made by the department as to the accuracy of the data and related materials. The act of distribution shall not constitute any such warranty, and no responsibility is assumed by the department in the use of these data or related materials.

Missouri Department of Natural Resources
Division of Environmental Quality
Hazardous Waste Program

Figure 2: Conceptual Site Model for OU1
Record of Decision for Interim Action for OU1
Oak Grove Village Well Site, OU1
Oak Grove Village, Missouri



Abbreviations and Acronyms

AOC	Administrative Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirement
bgs	below ground surface
CERCLA	Comprehensive Environmental Response Compensation & Liability Act
CFR	Code of Federal Regulations
CSF	Code of State Regulations
COC	Contaminants of Concern
COPC	Contaminants of Potential Concern
COS	City of Sullivan (refers to municipal wells)
DGLS	Department of Geology and Land Survey
DHSS	Missouri Department of Health and Senior Services
DNAPL	Dense Non-Aqueous Phase Liquid
DNR	Missouri Department of Natural Resources
EPA	U.S. Environmental Protection Agency
FR	Federal Register
FS	Feasibility Study
ft	feet
gpm	gallons per minute
GAC	Granular-Activated Carbon
HHRA	Human Health Risk Assessment
HI	Hazard Index
HRS	Hazard Ranking System
HWP	Hazardous Waste Program
ICs	Institutional Controls
LNAPL	Light Non-Aqueous Phase Liquids
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MRL	Minimal Risk Level
MWQS	Missouri Water Quality Standard
MW	monitoring well
NCP	National Oil and Hazardous Waste Substances Pollution Contingency
Plan	National Contingency Plan
NOAEL	No Observed Adverse Effect Level
NOV	Notice of Violation
NPL	National Priority List
NRHP	National Register of Historic Places
O&M	Operation and Maintenance
OGV	Oak Grove Village
OU	Operable Unit
OSWER	Office of Solid Waste and Emergency Response
PCE	Perchloroethylene or Tetrachloroethene
PHA	Public Health Assessment
PQL	Practical Quantitation Limit
ppb	parts per billion
PRG	Preliminary Remediation Goal

PRP	Potentially Responsible Party
RAO	Remedial Action Objectives
RCRA	Resource Conservation and Recovery Act
RG	Remediation Goal
RI	Remedial Investigation
ROD	Record of Decision
SALs	Soil Action Levels
SDWA	Safe Drinking Water Act
SLERA	Screening Level Ecological Risk Assessment
TBC	To Be Considered
TCE	Trichloroethylene
TSS	Total Suspended Solids
µg/l	micrograms per liter
USDA	United States Department of Agriculture
VOC	Volatile Organic Compounds

Responsiveness Summary of the Record of Decision for Interim Action
Oak Grove Village Well Site, Operable Unit 1
Oak Grove Village, Missouri

1. Overview

This Responsiveness Summary has been prepared in accordance with the Comprehensive, Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Reauthorization Act (SARA), and the National Contingency Plan (NCP) 40 CFR §300.430(f). This document provides the Missouri Department of Natural Resources' (DNR's) response to all significant comments received for the Oak Grove Village Well, Operable Unit 1 Proposed Plan.

In the Proposed Plan for Interim Action, the Missouri Department of Natural Resources (DNR), in close association and with concurrence from the U.S. Environmental Protection Agency (EPA), made a preliminary selection of the preferred remedial action alternative. The preferred remedial action alternative addresses the contamination at the Oak Grove Village Well Site (site), Operable Unit 1 (OU1).

Comments were received from interested citizens during the public meeting, which are included below. Written comments were received from the City of Sullivan and the TRW Automotive US LLC, which are also included below. The DNR and EPA did not find any information or comments requiring significant changes to the preferred alternative. Generally, the public accepted the preferred alternative.

2. Background on Community Involvement

The Post-Phase II Remedial Investigation/Feasibility Study (RI/FS) and the Proposed Plan for Interim Action for the Oak Grove Village Well Site, Operable Unit 1 were released to the public on August 1, 2007. The Post-Phase II RI/FS documents and the Proposed Plan for Interim Action, which are part of the Administrative Record, were made available for public review at the information repositories maintained at the Oak Grove Village City Hall and the Sullivan Public Library. An information repository is also maintained at the DNR in Jefferson City, Missouri. The notice of availability for these documents was published in the Sullivan Independent News on August 1, August 8, and August 15, 2007. The public meeting was held on August 15, 2007, in Oak Grove Village. The public comment period on these documents continued for 30 days from August 1, 2007, to August 30, 2007.

3.1 Comments from Interested Citizens Received during the Public Meeting

Comment 1:
In Alternate V, where is this alternate water supply (city water) coming from?

Response:
The alternate water supply (city water) will be supplied by the city of Sullivan. This issue was previously discussed with the city of Sullivan. The city of Sullivan agreed to provide city water via the alternate water supply. Based on the comments received by the city of Sullivan, recipients will need to agree to be annexed prior to being hooked up to the municipal water supply.

Comment 2:
Are you saying OGV's new municipal well is not functioning correctly? Regarding the selected remedial action alternative, isn't there something regarding the monitoring of OGV02?

Response:
No, the OGV municipal well (OGV02) is functioning correctly. OGV suspected that when the new municipal well (OGV02) was installed, that it would probably be contaminated, which it was. OGV installed an air stripper that removes the TCE to below 0.5 parts per billion.

OGV02 provides potable water to the residents and businesses via the distribution system. OGV is required to collect samples at least once per quarter per the DNR/Public Drinking Water Program in accordance with the Missouri Safe Drinking Water Law, RSMo 640.120.2 and RSMo 640.125.1 and the Public Drinking Water Regulations 10 CSR 60-4.100 (1to 10). As part of the remedial investigation at the site, the DNR collected water samples at OGV02 at least once per quarter through 2005. In 2006 and 2007, sampling was conducted semi-annually.

Yes, Alternative V discusses the continued monitoring of OGV02 after the Record of Decision for Interim Action for OU1 becomes final. OGV02 will be sampled as part of the selected remedy for interim action.

Comment 3:
So every five years or so the same process is repeated to determine if there is another problem and what will be done to correct it?

Response:
No, the remedial investigation is complete for OU1. However, every five years, the agencies are required to do an evaluation of the remedy to ensure that it is functioning as intended and is protective of human health and the environment.

Comment 4:
If the whole situation is amenable, is there really a problem?

Response:
Yes and No. It is true that the water from OGV02 is being successfully treated to remove TCE to below the MCL (Maximum Contaminant Level), but there is still a problem with the

contamination in groundwater. The residential and commercial/industrial wells need to be continuously monitored in order to assure that the TCE contamination in the wells does not exceed the MCL of 5 micrograms per liter or parts per billion.

Comment 5:
Does it do any good to put a filter on the drinking water, the faucet?

Response:
Yes. If individuals are concerned about possible exposure to TCE, then they can use drinking water filters to remove the TCE from the water faucet. For those homes above the cleanup level, whole-house carbon filtration systems will be installed as part of the interim remedy. These systems will further reduce exposure by treating water prior to its use for drinking, as well as other domestic uses such as showering.

Comment 6:
How deep are the wells in Oak Grove Village and Sullivan?

Response:
The municipal wells in Oak Grove Village are 805 feet and 900 feet. The municipal wells in Sullivan range from 655 feet to 1840 feet.

Comment 7:
When was the last time the residential wells were tested on Acid Mine Road? How do you know if a well has contamination if it is not sampled? Can a residential well be sampled again?

Response:
The last time the residential wells along Acid Mine Road were sampled was 2004.

During Phase I, well owners requested that their wells be sampled. Each well was sampled at least twice. If the well contained no contamination for two sampling events, then the well is not sampled again. If a well had contamination for two or more sampling events, then the well was sampled on a regular basis to monitor the contamination in groundwater to determine whether the contamination was over the MCL. During the Phase II RI (2004), a number of non-contaminated wells were sampled again.

There was one instance where a previously non-contaminated private well was resampled and contamination was detected. The well was resampled due to its location, just down the hill from other known wells impacted by contamination in groundwater. This well was added back onto the regularly sampled wells.

The DNR will be conducting another sampling event in October 2007. Any well that needs to be reevaluated will be sampled again for verification.

Comment 8:
If the city wells are up to a 1000 feet deep and the residential wells are up to 400 feet deep, would they be at different depths? Would that make a difference with the TCE contamination?

Response:
Yes, both the physical location and the depth of a well influence the amount of TCE contamination that is detected. Since TCE is a sinker, it generally migrates downward via available migration routes and pools at depth. This trait makes it very hard to locate and remediate TCE in karst topography.

Comment 9:
Is the Flying J well contaminated?

Response:
Yes, but not with TCE. The limited sampling of the Flying J well revealed no TCE or other COPC contamination in the well. However, toluene contamination was detected in the well. The well was sampled between June 25 to 30, 2005, with results ranging from 0.96 to 5.8 μg/l or ppb. The MCL for toluene is 1000 μg/l or ppb.

Comment 10:
What does TCE do to the human body?

Response:
Drinking small amounts of TCE for long periods may cause liver and kidney damage, impaired immune system function, and impaired fetal development in pregnant women, although the extent of some of these effects is not yet clear.

Breathing small amounts may cause headaches, lung irritation, dizziness, poor coordination, and difficulty concentrating.

Breathing high levels of TCE over a long period of time, as in an occupational setting, can cause dizziness, eye irritation, tremors, vomiting and nausea and possibly nerve damage. Other systems may also be affected.

It is also thought that TCE may cause cancer. Some studies of people exposed over long periods to high levels of TCE in drinking water or in workplace air have found evidence of increased cancer.

3.2 Comments from Interested Citizens Received by Letter

Comment:
The City of Sullivan may serve residents outside the Village and the City limits if feasible at the rates in effect at the time. If annexation is possible it is expected. If annexation is not

immediately possible, then an irrevocable petition for annexation needs to be provided so the property may be annexed when it is possible.

Response:
For any residential or commercial/industrial well that is contaminated above the MCL of 5.0 ppb, the agencies will determine the best way to provide a source of clean water. If it is determined that the well would not be feasible or practical to hookup to city water, or if the owner desires not to be annexed, then the agencies will implement the attachment of a whole-house filtration system for the contaminated well.

3.3 Current Comments from Potentially Responsible Parties (PRPs) Regarding OU1

Comment 1:
The DNR has failed to properly investigate potential source areas of TCE impacts in the immediate vicinity of the OGW wells.

Response:
The Post-Phase II investigation included investigations in the vicinity of the OGV wells.

The Village has owned the property, on which the OGV wells are located since 1964, when it became a village. Before that it was private property, owned by the original owners of the White House property.

The White House well, which is about 300 feet north-northwest of the OGV wells, was investigated. No TCE or other VOCs were detected in the White House well.

Along with the White House well, the Ditch Witch well (MW-5), the Sohn-Blanton-Wal-Mart well (MW-4), and the VFW well (MW-3) were also investigated. MW-5 is about 1/8 mile west of the OGV wells, MW-4 is about 1/4 mile southwest of the OGV wells, and MW-3 is about 500 feet south of the OGV wells. No TCE or other site-related VOCs were detected in the three monitoring wells.

In addition to groundwater sampling in the vicinity of the OGV wells, source area sampling was conducted on the Ditch Witch and the Sohn-Blanton-Wal-Mart properties. Sewer line and soil sampling conducted on the Sohn-Blanton-Wal-Mart property detected TCE and tetrachloroethylene (PCE). TCE and PCE were also detected in soil samples taken from the Ditch Witch property. MW-4 and MW-5 were installed to determine if the contamination had migrated off-site into the groundwater, contributing to the contamination detected in the OGV wells. No VOCs were detected in either well.

Tree core sampling was conducted twice on the Sohn-Blanton-Wal-Mart property. No TCE was detected in the trees. No tree core sampling was conducted on the VFW property, the Ditch Witch property, or the White House property due to lack of suitable trees.

Comment 2:
The DNR has failed to identify any supportable contaminant migration pathway between the TRW/Ramsey site and the OGV wells.

Response:
General groundwater flow direction can be determined for an area; however, faults/fractures and weathering of surface features, as well as pumping of wells, can influence groundwater in karst topography. Since the area below OGV and Sullivan contain faults/fractures and other karst features, the contamination in groundwater could flow in multiple directions. The direction that groundwater and the contamination in groundwater enters the well's cone-of-influence of any pumping well can also be difficult to determine, since a well's cone-of-influence is 360° around a well.

The DNR did not identify a flow path from the TRW/Ramsey site to the OGV wells. The Post-Phase II RI investigation eliminated all known source areas in OU1 and was unable to attribute the contamination to a specific source. Since the TRW/Ramsey facility is being investigated under RCRA Corrective Action, Superfund could not eliminate it as a possible source. If RCRA Corrective Action determines that TRW has complete capture of its plume, the source of TCE contamination in OU1 will remain an unidentified, significant source.

Comment 3:
The DNR continues to make gratuitous, unsupported assertions in an effort to implicate the TRW/Ramsey site.

Response:
See response to prior comment (Comment 2).

Comment 4:
The DNR advances a definition of OU1 that is unsupported.

Response:
When the EPA and DNR met last year (October 2006) to determine what needed to be completed after the Phase II RI was completed, the agencies decided to divide the OGV site into two operable units. At the time the Highway AF wells, COS09, and COS10 were included in Operable Unit 1 due to the TCE contamination detected in the wells and the wells' location to the OGV and Sullivan wells. The agencies also wanted to be sure the Highway AF wells, COS09, and COS10 were included in a continued monitoring program as outlined in OU1.

Comment 5:
The DNR failed to provide adequate and supported costs in the Post-Phase II RI.

Response:
The breakdown of the costs associated with the response actions for all the alternatives is found in Appendix A, Table B-1 through Table B-7. The costs were derived from various sources

technically or scientifically supported. Specifically, the RI completely fails to establish any hydrogeologic link, a chemical link, or a temporal link between the alleged sources and receptors.

Response:
See Section 3.3, Response 2.

Comment 2:
The RI incorrectly concludes that contaminant transport is dictated by a regional northeast flow of groundwater in the OGV/Sullivan area. The groundwater flow in the OGV/Sullivan area is to the southeast, not the northeast. Groundwater flow and thus contaminant transport is largely determined locally by the high topographic relief cause by the Meramec River, and by major pumpage of municipal drinking water wells. In fact, as recognized by the state's RCRA remedy for the TRW/Ramsey Site, COS Well #2 (COS-#2) captures the groundwater from the TRW/Ramsey Site."

Response:
The topographic relief in the OGV/Sullivan area dictates and controls the general groundwater flow direction. Since the OGV/Sullivan area sits on top of a topographic high, groundwater flows towards the lowest point. In the case of the OGV/Sullivan area, the lowest point is the Meramec River. Thus, groundwater flow is towards the Meramec River, which generally flows in a north to northeast direction.

Regarding the groundwater flow direction in Sullivan and towards Oak Grove Village, TRW's assertion fails to recognize that groundwater flow may have been different following the TCE release and prior to construction of COS02. Drainage to Winsel Creek prior to construction of COS02 is fairly likely. This would mean that flow from the TRW/Ramsey site might have occurred in more than one direction. Also, this assertion fails to recognize that transport may have occurred within Winsel Creek and entered the subsurface at a location remote from the TRW/Ramsey Site and towards the north.

Comment 3:
The RI does not quantify the contribution from the alleged sources and fails to account for the existence of chemicals at the receptors that do not exist at the alleged sources. As such, the RI wholly fails to adequately define the nature and extent of contamination in OU1.

Response:
In karst topography, it is difficult to define the specific nature and extent of TCE in groundwater. Although the findings of the remedial investigation were adequate enough to rule out specific potential source areas as contributing to the TCE contamination, the investigation was unable to attribute the contamination to a specific source.

Comment 4:
The RI does not identify or consider other potential sources of contaminants, as necessary to adequately define the nature and extent of contamination. Rather than performing a balanced

including:

a. The EPA for five-year review and educational materials costs is $305,000.
b. A drilling company's letter (Phase II FS) with closure costs with added inflation costs for the plugging and abandonment of OGV01 is $25,503.
c. The current DNR costs to monitor (groundwater sample) area wells including OGV02 with added inflation for the groundwater monitoring are $1,277,000.
d. A current contractor that supplies the OU2 treatment systems (carbon units) with added inflation for the treatment systems is $85,200.
e. Sullivan and OGV's costs to extend the waterlines and hookup homes to the distribution systems are $498,213.

OGV01's casing is steel and has been in the well since 1964. The video of OGV01 showed a deteriorated casing and the possibility exists that the grout around the casing is also very deteriorated. The last eighty feet of the well contains debris, which in part could be from the casing. Thus, the integrity of the well is questionable. These facts plus the lack of a pump, precludes the use of OGV01 as a backup well.

The DNR and EPA recognized that treatment systems are less costly initially; however, treatment systems require long-term maintenance to change filters and ensure the systems are operating effectively. Hooking homes to the public water supply would initially be more costly; however, there would be no long-term maintenance costs associated with this option. Based on previous sampling data in the Highway AF area, one to twenty homes could be impacted by TCE contamination above the MCL in the future. If this happens, then the choice between supplying city water verses wellhead treatment provides the agencies with the option of providing future impacted well owners with the best cost for a viable water supply.

The cost to monitor any impacted well with or without a treatment system in OU1 is part of the continued groundwater monitoring.

3.4 Past Comments from a PRP Regarding OU1

The following are the resubmitted questions from TRW regarding the Phase II Remedial Investigation (RI), the Phase II Feasibility Study (FS), the Human Health Risk Assessment (HHRA), the Ecological Risk Assessment (ERA), and the Phase II Proposed Plan. After DNR reviewed TRW's questions, the questions were sent to appropriate agencies for review and comment, including personnel from the Missouri Department of Health and Senior Services (MDHSS) and the DNR/HWP/Permit Section. The questions related to OU1 are included in this section with accompanying answers. The remaining questions without answers related to OU2 are included in the following section. A copy of all TRW's comments and questions can be found as a separate document in the Administrative Record.

Comment 1:
The purported contaminant migration pathway in the RI between the alleged sources (TRW/Ramsey) and the alleged receptors (the OGV Wells and Highway AF Wells) is not

investigation, it appears that the RI was intended to link pre-determined sources with contaminants at the alleged receptors. To accomplish this, the RI embraces unsound prior studies (such as the Barr Report) and ignores other potential sources of contamination (such as the Sohn and Blanton properties).

Response:
The Phase II RI did consider other potential sources areas in OU1, such as the Sohn-Blanton-Wal-Mart property. In addition, other sites previously not evaluated (such as the Ditch Witch property, a new-found drum disposal area, the closed Sullivan sewage lagoon, the closed OGV sewage lagoons, the current POTW system, and pond areas near Highway AF) were evaluated, and no other significant sources for the OU1 COPCs were identified.

Comment 5:
The RI ignores highly relevant and reliable data sources, including data developed as part of the RCRA Corrective Action at the TRW/Ramsey Site. This data confirms that groundwater underlying the TRW/Ramsey Site is captured by COS-#2 and that there is a barrier of clean wells between the TRW/Ramsey Site and the OGV Wells.

Response:
This comment does not address the remedy selection for the interim action for OU1. The DNR offers the following response:

Over time, groundwater monitoring will identify and/or verify if any potential source areas exist for OU1.

Comment 6:
The HHRA significantly overestimates risks to human health in OU1. As such, the HHRA should not serve as a basis for remedial decisions and actions at the Site.

Response:
The HHRA utilized Reasonable Maximum Exposure (RME) scenarios and followed the EPA's Risk Assessment Guidance for Superfund (RAGS) in deriving risk and hazard estimates. The RME is defined as the highest exposure that is reasonably expected to occur at a site (RME is a plausible estimate for individuals at the upper end of the risk distribution). The intent of the RME is to estimate a conservative exposure scenario that is well above the average case, yet still within the range of possible exposures. The HHRA follows appropriate guidance and does not overestimate risks to human health and rationally justifies the conclusions set for OU1 in the HHRA document.

Comment 7:
Given the major defects in the RI, it is premature to prepare a Feasibility Study (FS) or to propose a recommended alternative for OU1.

Response:
The RI provided adequate information to support the preparation of the FS for this interim action.

Comment 8:
The recommended alternative set forth in the Proposed Plan is not presented or analyzed in the FS.

Response:
This comment addresses the proposed plan issued in 2005 and does not address the current remedy selection for the interim action in OU1.

Comment 9:
How does the DNR reconcile the DNR-RCRA Program's findings that COS-#2 has captured and continues to capture and contain contaminants from the TRW/Ramsey site (based on over a decade of chemical analysis and groundwater level data) with the presumed pathway from the TRW/Ramsey site to the OGV Wells presented in the RI?

Response:
This comment does not address the remedy selection for the interim action. The DNR offers the following response:

The DNR/HWP/Permit Section staff has on many occasions made it clear to TRW that the DNR/Permit Section is concerned with potential karst and surface pathways, which have not been adequately characterized. The DNR/Permit Section feels that the dominant portion of the known plume is likely bounded by current knowledge. However, the DNR/Permit Section would not assert that all the contamination in groundwater from the TRW/Ramsey site is captured and contained by COS02. Although the DNR/Permit Section is uncertain as to potential future transport due to karst features and surface water paths, the DNR/Permit Section feels that the remedy offers an adequate containment for known contamination. The DNR/Permit Section still regards this view with some uncertainty. The DNR/Permit Section also has concerns with contaminant transport that may have occurred prior to installation of COS02 and this contamination may be detached from the known plume. It can be stated that the DNR/Permit Section feels that the current pumping rate captures any further dissolution from TRW/Ramsey site sources.

Comment 10:
How does the DNR account for the fact that the chemical ratio of parent-to-daughter compounds (i.e. TCE-to-DCE) is higher at the OGV Wells than at the TRW/Ramsey site?

Response:
This comment does not address the remedy selection for the interim action. The DNR offers the following response:

Contaminant ratios can change as they migrate in the aquifer.

Comment 11:
How does the DNR explain the lack of correlation between the substances and concentrations detected at the TRW/Ramsey site, COS-#2 and the OGV Wells?"

Response:
Different flow paths can affect contamination pathways. Uniform contaminant migration from a source is based on Darcy flow and is not applicable when evaluating contaminant migration in karst topography. The following explains the lack of correlation between the contaminants detected at the former TRW/Ramsey facility and the OGV Wells: (1) the detection and concentration at various wells is not affected solely by straight-line distance from source, (2) well depth has an impact on whether a contaminant is detected and the concentration, (3) complex pathways and karst transport will impact the concentration versus distance calculation, (4) contaminant entry into Winsel Creek and subsequent entry to the aquifer through the loosing stream segments will alter the concentration versus distance calculation, and (5) multiple releases taking different pathways can alter the concentration versus distance calculation.

Comment 12:
How does the DNR explain the fact that TCE levels are higher at the OGV Wells than at wells located between the TRW/Ramsey site and the OGV Wells, including COS-#2, COS-#3, and nearby monitoring wells?"

Response:
See responses to Comments 10 and 11.

Comment 13:
What are the source(s) of contaminants found at the OGV Wells that are not allegedly from the TRW/Ramsey Site?

Response:
Currently, the only other known source for the contamination in groundwater identified for the OGV wells is the closed Sullivan Landfill in OU2. This is based on the contaminants detected in the OGV wells and the commercial well (Voss well) associated with the closed Sullivan Landfill, which are not from the former TRW/Ramsey facility such as PCE, Freon™ 11 and Freon™ 12.

Comment 14:
Why has the RI ignored the potentiometric data from the TRW/Ramsey Site RCRA corrective action investigation, and why has there been no attempt to address the meaning of such data?

Response:
OU1 information and past potentiometric (i.e. water table) data was reviewed and considered regarding various technical documents prepared for the TRW/Ramsey Site. With the installation and operation of new wells within OGV and Sullivan, the potentiometric surfaces have changed. Since current potentiometric surfaces are not the same as historical potentiometric surfaces, the data was used where appropriate.

Comment 15:
Is there any groundwater flow modeling in the Administrative Record (beyond the Barr Report) that shows the capture demonstrated by the DNR/HWP/Permit Section investigation (including the attendant potentiometric maps)?

Response:
No. The Barr Report was the only groundwater flow model evaluated during the remedial investigation. Superfund did not evaluate the TRW model.

Comment 16:
Where in the Administrative Record is there support for the conclusion that groundwater migrates from the TRW/Ramsey site to the Oak Grove Wells?

Response:
See response to Comment 13.

Comment 17:
How does MDNR reconcile the capture of contaminants by COS02 with the alleged pathway from the TRW/Ramsey site to the La Jolla Springs?"

Response:
This comment does not address the remedy selection for the interim action in OU1. Contamination impacting La Jolla Spring will be investigated as part of OU2.

Comment 18:
How does MDNR explain the lack of correlation between the COPCs at the TRW/Ramsey site and at La Jolla Springs, including the fact that there has only been a single detection of Freon 11 at TRW/Ramsey site, but Freon 11 is measured in every sample at La Jolla Springs?

Response:
This comment does not address the remedy selection for the interim action in OU1. Contamination impacting La Jolla Spring will be investigated as part of OU2.

Comment 19:
Where in the Administrative Record is there support for the conclusion that groundwater migrates from the TRW/Ramsey site to the La Jolla Springs?"

Response:
This comment does not address the remedy selection for the interim action in OU1. Contamination impacting La Jolla Spring will be investigated as part of OU2.

Comment 20:
What investigatory activities has MDNR undertaken to attempt to locate a source of carbon tetrachloride in the area?

Response:
The DNR has not conducted any separate investigations to determine the source of the carbon tetrachloride in the Highway AF area because carbon tetrachloride is not a site contaminant of concern and it has not been routinely detected.

Comment 21:
Where in the Administrative Record is there support for the conclusion that groundwater migrates from the TRW/Ramsey site to the Highway AF Wells?

Response:
This comment does not address the remedy selection for the interim action in OU1. However, the DNR offers the following response:

In the Phase II RI Report, it states in several places that the current groundwater flow directions and flow paths may be different from historical groundwater flow directions and flow paths, such as discussed in Section 2.2, Section 7.2, and Section 9.0

Comment 22:
What are the source(s) of contaminants found at the Highway AF Wells, particularly BCP that are not allegedly from the TRW/Ramsey site?

Response:
This comment does not address the remedy selection for the interim action in OU1. However, the DNR offers the following response:

1,2-Dibromo-3-chloropropane (DBCP) was detected on one occasion each in a Highway AF private well, the commercial well (Voss Well) associated with the closed Sullivan Landfill, and OGV01. DBCP was detected in the Highway AF private well on 05/11/04, in the Voss Well on 11/16/04 and in OGV01 on 03/27/04. Currently a known source for the Highway AF plume does not exist, so the DNR does not know where the DBCP or other site contaminants that make up the Highway AF plume originate.

Comment 23:
How does the DNR explain the lack of correlation between the substances and concentrations detected at the TRW/Ramsey site and the Highway AF Wells, particularly DBCP?

Response:
See response to comment 22.

Comment 24:
Why did the DNR not investigate other potential sources, such as septic tank cleaners, wastewater lagoons, Meramec Industries, and the previously unidentified buried drum area that was recently discovered in the area?

Response:
The DNR did not ignore or dismiss other potential sources of contamination. All known potential source areas were investigated as part of the Phase I, Phase II or Post-Phase II investigations. All data collected from site-related investigations were reviewed and incorporated in the Post-Phase II RI investigation and report.

Comment 25:
The HHRA should be updated and should not serve as a basis for remedial decisions and actions in its present form. The current risks presented in the HHRA do not represent current risks to people in the area. Risks and hazards presented in the HHRA assume unrestricted use of impacted groundwater as drinking water and constituent concentrations in the tap water that are not representative of local groundwater. The addition of a section that presents current risks with existing exposure controls in place as well as risk for each well or for a much smaller grouping of wells (grouped based on very local groundwater flow) should be included to provide a more complete understanding of current risks.

A complete list of potentially impacted private wells in the area that identifies those that are currently being treated and provides pre- and post-treatment water quality data should be provided to present a more complete understanding of potential exposures through use of groundwater as tap water in the area. Pre- and post-treatment information is only provided for a limited number of wells."

Response:
The MDHSS used the appropriate guidance to calculate site risk. The MDHSS agrees that people are not currently using groundwater impacted above Maximum Contaminant Levels (MCLs) for drinking water in the area and specifically states this in the HHRA. Based on the existing exposure controls at the site, current risks presented in the HHRA for groundwater exposures were not quantitatively evaluated with the exception of one commercial facility in OU2 that may obtain drinking water from an impacted well with no exposure controls in place (Well PH016). The following discussion regarding current exposures is provided in Section 3.2 of the HHRA:

> "The contaminated municipal wells are subject to National Primary Drinking Water Regulations (NPDWRs or primary standards), which are legally enforceable standards that apply to public water systems. Primary standards protect public health by limiting the levels of contaminants in drinking water. If any site contaminants exceed the Maximum Contaminant Levels (MCLs) set forth in the primary standards, immediate action would be taken to prevent continuing human exposure.
>
> Private wells are not subject to the primary standards. Currently, private residential drinking water wells with contaminant concentrations that exceed the MCLs have carbon filtration units to reduce the contaminant level in drinking water supply.

> MDNR routinely samples the groundwater pre- and post-filtration to ensure that these systems provide drinking water at levels below the relevant MCLs. Therefore, onsite residents do not currently ingest contaminated water at concentrations above MCLs from the wells. No laws, regulations, ordinances, or agreements have forced the residents to close contaminated wells onsite."

Additional discussions regarding current groundwater exposures are contained in the following sections of the HHRA: Section 3.3, Section 5.1.1, Section 5.2.1, and Section 6.0. Also, pre- and post- treatment information was not provided in the HHRA because it was not needed in this analysis since current exposures to impacted wells with carbon filtration systems are not quantitatively assessed.

Furthermore, a baseline risk assessment evaluates potential human health risks in the absence of any actions to control or mitigate exposure; therefore, the HHRA does assume unrestricted use of impacted groundwater for future scenarios and quantitatively evaluates potential risks to future residents and future workers. Well groupings were determined primarily on locations of the wells in relation to the three identified areas of significant contaminant impacts to groundwater and representative concentrations were determined based on the assumption that future use could occur from anywhere within each of the three impacted areas.

Comment 26:

Plume areas identified in the HHRA are named in such a way that suggests the sources are known. This is not the case. Naming the area that includes the TRW/Ramsey site as the "TRW Plume" suggests that TRW is source of constituents for those wells included in the plume. The following issues should be addressed:

- The OGV wells are included in the so called "TRW plume." However the OGV wells are impacted with constituents that are not from the TRW/Ramsey Site. Groundwater at the OGV wells is impacted with TCE, associated breakdown products, DBCP, fuel hydrocarbons, and Freon. The HHRA states in Section 1.3 (paragraph 6) "These investigations identified the Sullivan Landfill, the TRW/Ramsey facility (a Resource Conservation and Recovery Act site), and two automobile service stations as potential sources of TCE. Based on currently available information, however, the contamination detected in the Oak Grove Village wells cannot be conclusively attributed to any of these potential sources."

  - DBCP contributes to risk in the "TRW plume" area and clearly is not associated with historical operations at the TRW/Ramsey facility.

The approach to evaluating risks associated with wells in the area should be refined based on the data, COCs and the hydrogeology.

- Wells in selected areas are grouped and risks evaluated for these areas. These include the "Highway AF" area, "Sullivan Landfill," "TRW," COS9, and COS10 (see Table 1 in Appendix O). The rationale for grouping the wells and the basis for choosing the concentrations used to estimate risk and hazard within these areas (estimated from the well with the highest detected level of each COC) is not clear and does not appear to be based on the analysis provided in the RI. Receptors in these areas have not been impacted by one source. The HHRA states that the plume areas were identified based on a Personal Communication with Candice McGhee June 15th, 2004. Additional documentation should be provided to support organization of the groundwater data as indicated.

- The "TRW Plume" as defined in the HHRA is a fiction. It measures roughly 0.7 miles from COS-#4 to COS-#6, 1.6 miles from COS-#6 to COS-#7, 1.5 miles from COS-#7 to the OGV Wells, and 1.9 miles from the OGV wells back to COS-#4. These four wells (COS-#4, COS-#6, COS-#7, and OGV) form a quadrilateral that encompasses all the wells in the "TRW Plume." Taking the smallest dimensions of an inscribed rectangle gives an area of roughly one square mile. While the thickness of the "plume" is variable, the general indication is that the thickness must be in the range of 100 feet. This size and shape shows, along with the chemical and hydraulic data, that this area is affected by more than one source and is not a single plume."

Response:
Plume areas were not named in the HHRA to suggest that the sources were known. The MDHSS agrees that the referenced plume areas may be influenced by more than one source. For risk assessment purposes, the source or origin of the contaminants is not a primary consideration – where the contaminants come to be located and available for contact with receptors is what determines relevant exposure pathways. The MDHSS consulted with the DNR's Remedial Project Manager in naming the plume areas and in grouping the wells into specified areas. The names were chosen simply to provide a logical reference to the three primary areas with significant impacts to groundwater. Well groupings were determined primarily on locations of the wells in relation to the three identified plume areas.

The objective of the HHRA is to provide an estimate of the reasonable maximum exposure and because of the contaminant mobility in groundwater, the HHRA assumes that contaminant concentrations may be available for future exposure by residents or workers from anywhere within each of the three impacted areas. Future potential risks were determined in each area by selecting the well with the highest detected level of each Contaminant of Potential Concern (COPC) and Exposure Point Concentrations (EPCs) were then estimated by using the temporal average of each COPC from the selected wells. This methodology was chosen in consultation with EPA Region VII and is standard practice when trend data is available from existing wells.

Comment 27:
Toxicity values should be consistently used based on the most appropriate values for the regulatory framework, route of exposure, receptor, and best science. The HHRA does not consistently use the latest values provided by USEPA (e.g., USEPA IRIS) and does not consistently use those values recommended in Missouri's latest guidance (e.g., MRBCA Technical Guidance [February 2005]). The assessment should be consistent with the most up-to-date values, and with the regulatory context. Please address the following specific comments:

- There is considerable uncertainty associated with the TCE toxicity values for use in quantitative risk assessment and values vary significantly and result in a wide range of risks. For example, the range of inhalation cancer slope factors (CSFs) provided in the draft USEPA document *Trichloroethylene Health Risk Assessment: Synthesis and Characterization* (USEPA 2001) vary 20-fold and are based on different studies (one derived from an occupational inhalation exposure study – 2 x 10^{-2} $[mg/kg\text{-}day]^{-1}$, values derived from mouse cancer bioassay data – 3 x 10^{-2} to 2 x 10^{-1} $[mg/kg\text{-}day]^{-1}$, and one based on a residential drinking water study – 4 x 10^{-1} $[mg/kg\text{-}day]^{-1}$). The most potent is 57 times the value recommended for use in risk assessments by Missouri (RBCA 2005). The state of Missouri recommends using an inhalation slope factor of 7.4 x 10^{-3} $(mg/kg\text{-}day)^{-1}$ (2005), which was adopted by California EPA Hot Spots program in 2002. The values used in the HHRA were not chosen based on those most appropriate for the route of exposure or the receptor being evaluated in the assessment. Updating the assessment based on a more refined use of toxicity values changes the conclusions for certain receptors and areas.

USEPA is scheduled to release the draft TCE IRIS assessment with updated toxicity values for review in March of 2008 and the final values are scheduled to be posted on IRIS in November of 2008. Risks and actions taken to mitigate the risks associated with exposure to TCE should be reevaluated based on the final IRIS values. If the exposure controls (for example, treatment units on private and public wells) that are currently in place are maintained over this period, risks associated with exposure during this period will continue to be acceptable.

- In the HHRA evaluation, DBCP significantly contributes to estimated cancer risk associated with the so-called "Highway AF" and "TRW" Plumes. The toxicity value used to evaluate cancer risk associated with DBCP should either be the value recommended for use in Missouri's guidance or the value used by USEPA (e.g., USEPA Region 3 RBCs 2004 and USEPA Region 9 PRGs 2004). MDNR did not use the toxicity values provided in Missouri RBCA (2005) guidance or the value used in USEPA Region 9 PRGs to evaluate risks associated with DBCP. Instead, the HHRA used a toxicity value developed by California that results in a higher estimate of risk. The California DBCP oral slope factor that was used is 7.0 $(mg/kg\text{-}day)^{-1}$. The slope factor provided in Missouri's tables and used by Region 9 is 1.4 $(mg/kg\text{-}day)^{-1}$. The oral RfD value provided in the Missouri RBCA tables also was not used."

Response:

As stated in the HHRA, the EPA hierarchy was utilized in obtaining toxicity values for this risk assessment. The hierarchy utilized is as follows:

- Tier 1: EPA's Integrated Risk Information System (IRIS)
- Tier 2: EPA's National Center for Environmental Assessment Provisional Peer Reviewed Toxicity Value (PPRTV) Database and Risk Assessment Issue Papers
- Tier 3: California Environmental Protection Agency's (CalEPA) Office of Environmental Health Hazard Assessment Toxicity Criteria Database, the Agency for Toxic Substances and Disease Registry's (ATSDR) Minimal Risk Levels, or EPA's Health Effects Assessment Summary Tables (HEAST).

Additionally, the Missouri Risk-Based Corrective Action (MRBCA) guidance could not be used for this HHRA for two reasons. First, the Oak Grove Village Well Site is a National Priorities List (NPL) site and MRBCA guidance is not applicable to NLP sites under Superfund. Second, the MRBCA guidance was in draft form and not applicable for use when this HHRA was completed. Therefore, MRBCA values were not consulted for this risk assessment.

Trichloroethene (TCE) Toxicity Values:

The HHRA notes that there are varied provisional carcinogenic toxicity values proposed for TCE. The MDHSS followed guidance provided by the EPA Region VII by assessing risk posed by TCE using the most conservative of the draft slope factors from the 2001 draft TCE Health Risk Assessment along with the original provisional values provided in the 1985 assessment document and 1987 addendum. Due to the uncertainty regarding TCE cancer risks, utilizing a range of toxicity values provides an assessment of both the high-end of potential cancer risks and the low-end of potential cancer risks.

1,2-Dibromo-3-chloropropane (DBCP) Toxicity Value

Again, EPA's hierarchy was utilized in obtaining toxicity values for this risk assessment. Also, to reiterate, Superfund does not follow the MRBCA guidance on NPL sites. The oral slope factor included for DBCP was obtained from CalEPA, which is a Tier 3 source. This value was chosen because it is more recent and more conservative than the HEAST value. Additionally, this value is in fact provided in the EPA Region 9 tables, in addition to the HEAST value. See the discussion provided in Comment 30.

Comment 28:
The assumptions used in the HHRA lead to an overestimate of exposure and therefore risk. Exposure to constituents in tap water should be based on the best available data and information. Exposure estimates must be based on a rigorous evaluation of the data and the strongest science possible. Please address the following specific comments:

- Risks associated with DBCP and TCE are evaluated in the so called "TRW Plume" based on the maximum detected concentration (see Table 4e). DBCP appears to have been detected at the MCL (0.2 ug/L) at OGV1 (which is closed) and the exceedances appear to represent samples reported as non-detects with detection limits that exceed the MCL. A number of samples were reported with detection limits that exceed the MCL, resulting in a calculated EPC, which was above the MCL. An additional evaluation of the data that either eliminates or uses scientifically-based methods for dealing with the non-detections should be used to provide a better understanding of the significance of this data.

- The amount of DBCP likely to volatize from impacted tap water at a given concentration has been over-estimated. This over-estimates exposure and therefore risk. The assessment assumes that half of the DBCP in groundwater volatilizes to indoor air during use as tap water. Inhalation exposure to DBCP in drinking water accounts for a significant portion of the calculated excess cancer risk in the so-called "Highway AF" and "TRW" plumes. The approach used in the assessment unreasonably over-estimates the potential for exposure.

The approach used is referenced with an article written by John Schaum. However, the Schaum article indicates that "this range [0.5-0.9] of values for fraction volatilized would not be applicable to less volatile chemicals [less volatile than chloroform and trichloroethylene]." The Henry's Law constant for DBCP (1.47×10^{-4} atm-m^3/mol) indicates that this chemical is an order of magnitude less volatile than chloroform (Henry's Law constant of 3.66×10^{-3} atm-m^3/mol) and trichloroethylene (Henry's Law constant of 0.0103). The Schaum article gives an equation to determine the fraction volatilized from a compound compared to the known values from a different compound. A chemical specific calculation using the equations presented in the article should be used to determine the fraction of DBCP volatilized.

Response:
Risk assessment is built upon conservative estimates of the possibility for adverse health effects from exposure and contains many uncertainties – such uncertainties may lead to an overestimation or underestimation of the site risks.

Evaluation of Data and Calculation of Groundwater EPCs

The maximum concentration for each COPC detected within each grouping of wells was not used to estimate risk for all the wells in each area. Rather, risks associated with groundwater were estimated for each COPC in each plume using the well with the highest detected level of each COPC. This approach assumes that contaminant concentrations may be available for future exposure by residents or workers from anywhere within each of the three impacted areas.

EPCs were calculated using the temporal average of the contaminant concentration in the wells with the highest detected contaminant level to provide a reasonable maximum exposure for each plume of contamination. Following RAGS guidance, estimated values ("J" qualified data) were treated the same as positive detections. In addition, following the *Risk Assessment Guidance for Superfund: Volume I* (RAGS) guidance, to calculate representative concentrations, positive results were combined with one-half the quantitation limit for non-detects. One-half of the detection limit is used as a proxy concentration when the possibility exists that a chemical may be present below the quantitation limit.

Risks Associated with DBCP

The risks associated with DBCP in the TRW Plume were estimated using the approach described above and were in fact based on the temporal average, which included one estimated value combined with the non-detects. The estimated value is 0.2 ug/L, while the EPC used in the assessment is minimally different, calculated at 0.27 ug/L. It should be noted also that to ensure risks are not underestimated, it is important not to exclude chemicals that may be present below quantitation limits especially when the quantitation limit exceeds relevant health-based reference values.

The use of 0.5 as the fraction volatilized for inhalation scenarios was applied to all volatiles in each scenario in the assessment and assumes that half of each concentration of each chemical will be transferred to the air. MDHSS acknowledges that the Schaum articles notes that the range of values 0.5 – 0.9 for the fraction volatilized would not apply to less volatile chemicals. However, volatiles are commonly considered those with a Henry's Law Constant (HLC) of greater than 1×10^{-5} atm-m^3/mole and a molecular weight (MW) of less than 200 g/mole. DBCP is considered a borderline volatile with a HLC of 1.47×10^{-4} and a MW of 236.36. MDHSS chose the value (0.5) at the lower end of the recommended range and applied this to all chemicals. In addition, the Andelman approach which is used in the assessment for residential exposures also assumes 0.5 as the fraction volatilized and this simple approach is commonly used in risk assessments. Furthermore, had MDHSS chosen to calculate chemical-specific fraction volatilized, we would have done so far all chemicals. Thus, the potential risks from DBCP or other chemicals may have been slightly lower. However, potential risks from several of the other chemicals would likely have been slightly higher. Therefore, MDHSS believes assuming 50% volatilized is a balanced, reasonable approach.

Comment 29:
The data should be more rigorously evaluated to estimate exposure in the HHRA. Please address the following issues:

- The dataset used to estimate exposure to DBCP in groundwater consists predominantly of non-detects and a few "J" qualified values. The non-detects were represented as half the detection limit. Standard laboratory methods are not sensitive enough to detect DBCP below the MCL. Many of the samples reported as non-detects are greater than two times the MCL. As a result, the estimated risk is driven by non-detects with a few estimated values.

- There is only one detection (an estimated detection) of DBCP in OGV1 on 3/27/04 (Table A-3). The minimum detection is the only detection, and the maximum detection is 1/2 the highest method detection limit. The potential exposure to DBCP and the validity of using these data points to estimate risk within the context of the entire data set should be re-evaluated.

- There appear to only be two detections of DBCP, and both are estimated concentrations below the PQL. The potential exposure to DBCP and the validity of using these data points to estimate risk within the context of the entire data set should be re-evaluated.

Response:
Risks associated with groundwater were estimated for each COPC in each plume using the well with the highest detected level of each COPC. EPCs were calculated using the temporal average of the contaminant concentration in the wells with the highest detected contaminant level to provide a reasonable maximum exposure for each plume of contamination. Following RAGS guidance, estimated values ("J" qualified data) were treated the same as positive detections. In addition, following RAGS guidance, to calculate representative concentrations, positive results were combined with one-half the quantitation limit for non-detects. One-half of the detection limit is used as a proxy concentration when the possibility exists that a chemical may be present below the quantitation limit.

The risks associated with DBCP in the TRW Plume were in fact based on the temporal average, which included one estimated value combined with the non-detects. The estimated value is 0.2 ug/L, while the EPC used in the assessment is minimally different at the calculated value of 0.27

ug/L. Given that standard laboratory methods are not sensitive enough to detect DBCP below the MCL and the possibility existed that DBCP may be present in the non-detect samples below the quantitation limit, MDHSS believes the approach used to estimate risk is reasonable.

Comment 30:
In some cases, changing the toxicity values to the most appropriate and refining the exposure assumptions changes the conclusion from conditions that are "not acceptable" to "acceptable."

Response:
The MDHSS believes that risk assessments should be completed using conservative toxicity values and exposure estimates that are protective of RME scenarios. The MDHSS believes the range of toxicity values for TCE used in the assessment, and the use of both average and maximum concentrations, provides a reasonable assessment of the potential risks.

Comment 31:
The RI presents data that does not appear to have been considered in the preparation of the HHRA. In some cases this contributes to an overestimate of risk and in some cases it may contribute to an underestimate of risk.

There are over twenty such inconsistencies between data in the RI and the HHRA. The example is:

1. Xylenes were detected in COS08 but were not retained as a COC in the HHRA.

The HHRA fails to state why all the available data was not used. If data presented in the RI is not deemed appropriate for use in the risk assessment, the rationale for eliminating the data needs to be provided. Data consistency issues need to be resolved."

Response:
The Remedial Investigation (RI) does in fact present data that was not considered in preparation of the HHRA. The RI and HHRA were conducted and completed concurrently. Since the investigation was ongoing when the HHRA was being worked upon, all the data was not available for inclusion in the HHRA; therefore, a cutoff date was chosen for data included in the HHRA. The HHRA used sample results obtained during the site investigations, including data from 2000 and 2001 as summarized in the Phase I RI Report, along with data obtained during recent sampling events up to May 2004 for groundwater.

1. Xylenes: The data provided to MDHSS does not indicate that Xylenes were detected in COS08 well during the time period for samples included in the HHRA.

Comment 32:
What is the basis for selecting the wells, which are in the designated "Plume" areas, which were used to evaluate exposure to groundwater as drinking water in the "Plumes?

Response:
MDHSS consulted with MDNR's Remedial Project Manager in grouping the wells into specified areas, and well groupings were determined primarily on locations of the wells in relation to the three identified plume areas. For all HHRA discussions and calculations completed, the OGV Well Site is grouped into three distinct plumes (TRW Plume, Sullivan Landfill Plume, and Highway AF Plume), while the RI discussions definitely have two distinct plumes (TRW Plume and Sullivan Landfill Plume) with an uncertainty related to the third plume (Highway AF Plume) as it being a distinct plume or a part of one or both of the other two plumes.

Comment 33:
How does using the maximum detected for COPCs in the chosen clusters of wells reasonably represent current and future scenarios?

Response:
The temporal average from the well with the highest detects in each plume was used, not the maximum detect. Additionally, as previously noted, the HHRA assessed future risks for each of the three impacted areas – current risks were only assessed for Well PH016, which is found in OU2 and is currently used as a commercial facility with no existing exposure controls in place. Also as previously noted, the objective of the HHRA is to provide an estimate of the reasonable maximum exposure. Because of contaminant mobility in groundwater, the HHRA assumes that contaminant concentrations may be available for future exposure by residents or workers from anywhere within each of the three impacted areas.

Comment 34:
Why wasn't the exposure estimate based on a more refined analysis, since the assessment is looking at real receptors?

Response:
The HHRA utilized RME scenarios and followed EPA RAGS in deriving risk and hazard estimates. The groundwater scenario primarily utilized recommended default values because future scenarios were primarily being looked at and more refined assessments generally are not warranted except in instances where activity and use patterns differ greatly from default values.

Comment 35:
What is the date of issuance of Alternative VI (a) and why was it not first issued as an addendum to the FS?

Response:
This comment addresses the proposed plan issued in 2005 and does not address the current remedy selection for the interim action in OU1.

Comment 36:
How does MDNR quantify and defend the costs of Alternative VI (a), if they are not presented in the FS?

Response:
This comment addresses the proposed plan issued in 2005 and does not address the current remedy selection for the interim action in OU1.

Comment 37:
Why did the DNR reject a remedial method, specifically groundwater extraction that has been demonstrated to be effective in the Sullivan area?

Response:
This comment addresses the proposed plan issued in 2005 and does not address the current remedy selection for the interim action in OU1.

Groundwater extraction has not been rejected as a remedial option. The selected remedy is an interim action to ensure there are no exposures to contaminated groundwater in OU1 pending further consideration of groundwater treatment alternatives.

Comment 38:
How can the DNR propose a remedial alternative it apparently has no confidence will be effective?

Response:
This comment addresses the proposed plan issued in 2005 and does not address the current remedy selection for the interim action in OU1.

Comment 39:
How can MDNR defend meeting the criteria, based upon the uncertainty presented in the statements above?

Response:
This comment addresses the proposed plan issued in 2005 and does not address the current remedy selection for the interim action in OU1.

Comment 40:
As noted above, Alternative VI (a) was not evaluated in the FS. Therefore, its presentation in the Proposed Plan as the preferred alternative is not conducive to thorough review and public comment. The FS should be reissued, after issuance of an adequate RI. At that time, all remedial alternatives should be identified and evaluated in the FS."

Response:
This comment addresses the proposed plan issued in 2005 and does not address the current remedy selection for the interim action in OU1.

Comment 41:
How is the definition of the nature and extent of contamination and the identification of sources presented in the RI adequate to allow for the formulation and screening of alternatives in the level of detail required by the NCP and the 1988 RI/FS Guidance?

Response:
The findings and conclusions of the Post-Phase II RI, especially the nature and extent of contamination and the identification of source areas, as presented in the Post-Phase II RI document were adequate to allow for the formulation and screening of alternatives in the level of detail required by the NCP and the 1988 RI/FS Guidance.

Comment 42:
Based upon the discovery of a previously unidentified buried drum area, why did the state not conduct a more thorough investigation for other possible disposal sites?

Response:
The DNR did conduct a thorough investigation of other possible disposal sites. The DNR and EPA evaluated multiple files and databases regarding operations in the Sullivan/Oak Grove Village area, as well as issuing 104(e) information request letters. At every public meeting and during all on-site sampling events for the remedial investigation, the agencies encouraged the public to provide us with any knowledge of possible disposal areas. Using the information provided, the DNR conducted investigations on all other identified possible source areas. As previously unknown disposal sites were discovered, they too were investigated. The investigation of potential source areas for OU1 continued on after the completion of the Phase II RI/FS. No significant source areas for OU1 were identified.

Comment 43:
Why are there no estimates of contaminant reduction identified for the alternatives proposed in the FS?

Response:
The selected remedy is an interim action to prevent exposures to contamination in groundwater. No final remedy has been proposed to remediate the groundwater at OU1.

Comment 44:
Why are various remediation timeframes not provided for the various alternatives considered as required by the 1988 RI/FS Guidance?

Response:
The selected remedy is an interim action to prevent exposures to contamination in groundwater. No final remedy has been proposed to remediate the groundwater at OU1. However, the costs for the alternatives developed in the FS were based upon a 30-year time period.

Comment 45:
How can effectiveness and cost be evaluated when the source of contamination is inadequately defined?

Response:
The effectiveness of this interim action does not require the identification of a source. The selected remedy is an interim action to prevent exposures to contaminated groundwater. The FS provides the cost for the individual response actions that will be used in the site's remedial action alternative. The individual responses contain costs based on actual quotes, engineering judgement based on similar projects, and the cost estimating guides/references. Oversight, data analysis, and reporting are included in the cost estimates as well as contingency costs. The costs are believed to be within the accuracy range of +50 percent to –30 percent suggested by the FS guidance. The present value (i.e. the amount of money needed to set aside at the initial point in time to assure that the funds will be available in the future as they are needed) for each alternative is provided in the footnotes of Tables 5-3 through 5-8.

Comment 46:
What analysis has been completed to support a contention that the cost estimates included in the RI/FS will permit the selection of a remedy within the required cost estimating range?

Response:
See response to Comments 5 and 45. The NCP, Section 300.430 (e)(9)(iii)(G), states the following:

"Cost. The type of costs that shall be assessed include the following:

(1) Capital costs, including both direct and indirect costs;

(2) Annual operation and maintenance costs; and

(3) Net present value of capital and O&M costs."

Each of the above items is included, where applicable, in the FS cost estimates.

Comment 47:
What is the basis of the present worth analysis of the alternatives considered in the detailed alternative analysis of the FS?

Response:
See responses to questions #45 and #46 above. All present worth analysis calculations are provided in the footnotes to Tables 5-3 through 5-8. They were calculated in accordance with the EPA guidance document, "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" July 2000, OWSER 9355.0-75, using a 7% discount factor and annual discount factors as provided in the guidance document.

Comment 48:
Has a Cost Sensitivity Analysis been conducted for the alternatives considered? If so, where in the FS is this Cost Sensitivity Analysis presented and documented?

Response:
A Cost Sensitivity Analysis is optional and was not performed.

Comment 49:
First the report states the general groundwater trend is to the northeast. That particular flow direction would take contaminants away from the Oak Grove Village well.

Response:
We agree. The natural groundwater flow direction in the Ozark Aquifer beneath the OGV wells and the former TRW/Ramsey facility in OU1 are east-northeast. Dye trace studies also confirm a strong connection between the groundwater in the vicinity of the OGV wells and the former TRW/Ramsey facility. The historical use of groundwater around OGV01 and the heavy private and commercial/industrial development in OU1 has resulted in a cone of influence (depression) that has historically extended from OGV01 in all directions. This is also applicable to OGV02.

Comment 50:
If the Oak Grove Village well, due to its cone of depression, influenced the aquifer to the extent that it would cause the groundwater to reverse flow, this would require that the Oak Grove Village well be pumped continuously for long periods. The original well, I believe, has not been pumped much in the past several years and I don't believe the new well has been in operation for very long."

Response:
Yes, OGV01 has not been operational for a number of years. When OGV01 operated, the pumping rate was 100 gal/min. OGV02 has been in operation since April 2005, and is operated regularly, with a pumping rate of 125 gal/min for 8 hours/day.

Comment 51:
If COS09 and COS10 are contributing to changing the flow direction in the aquifer due to their cones of depression, then logically they should both be experiencing similar contamination levels as the Oak Grove Village well. They are not. And since COS10 is closer to the Landfill and has been more or less continuously pumped for about 10 years, which is certainly considerably more than the Oak Grove Village well, then logically it would be assumed that COS10 would be experiencing at least the level of contamination that the Oak Grove Village well has. It is not. Similarly, COS09, which has been in operation since the middle 80's and is about the same distance as the Oak Grove Village well from the Landfill, should have exerted significant influence over the plume, if it exists. There is only 20 years that separates the installation of the Oak Grove Village well and COS09 and over 20 years from then till now and yet COS09 does not have the level of contaminant that the Oak Grove Village well is experiencing."

Response:
Two factors that effect the COPCs found in the wells are depth of the well, and rate (gallons per minute) and duration of pumping. The depth of COS10 is 1840 feet, the depth of COS09 is 775 feet, while OGV01 is 805 feet and OGV02 is 900 feet. The additional column of water COS10 extracts when operating can dilute the COPCs found in the well to the point of non-detect or very low levels. When OGV01 operated, it was pumped regularly at about 100 gals/min. Currently OGV02 pumps regularly at 125 gals/min for 8 hours/day. COS09 and COS10 operate sporadically, when needed. As noted by Sullivan personnel before OGV02 became operational, the pumping rate of COS09 was lowered due the increase of TCE in the well at its more normal pumping rate. For these reasons, COS09 and COS10 would not be as contaminated as the OGV wells.

Comment 52:
Based on the information in the report, it could also be assumed that COS09 and COS10 would act as a "sink" that would attract contaminants from the Landfill towards and away from the Oak Grove well.

Response:
The DNR is unclear as to how this conclusion was reached. When OGV did not have an operational well, the two COS wells probably drew contamination away from the OGV wells. This would explain why the contamination seen in COS09 continued to rise until Sullivan reduced the flow rate. Any contamination detected in COS10 would be detected at very low levels due to the large column (amount) of water extracted from the well. Since COS10 is Sullivan's deepest (1890 feet) well, the large column of water extracted with each well volume pumped would dilute any contamination in the water.

Based on current well operational data, COS09 and COS10 are only used when needed, do not operate at the same time, and the flow rates are 100 to 150 gallons per minute. Since OGV02 began operation in April 2005, it has operated daily with a flow rate of 125 gallons per minute for 8 hours/day. The constant use of OGV02 would actually draw the contamination in groundwater away from COS09 and COS10 towards OGV02. This statement is supported by the continued rise of contamination in OGV02. Future sampling of COS09 may also support this as seen with a reduction of contamination in groundwater in COS09 at its current use and flow rate.

Comment 53:
According to the report, significant contaminants were deposited in the Landfill circa 1982 with potentially unknown quantities placed there prior to then but no earlier than 1970. This indicates no more than a 10-year separation between the time the Oak Grove well was pumping to the time that COS09 began pumping. This would further tend to indicate that, based on the information in the report, that COS09 should be experiencing nearly the same levels of contamination as the Oak Grove well.

Response:
This comment does not address the remedy selection for the interim action in OU1. However, see response to Comment 51.

Comment 54

It is our understanding that the new monitoring wells that were drilled were uncased. If this is true, we are unclear as to what useful information could be reasonably collected. Since most of the potential contaminants have a specific gravity greater than water, it is logical to assume that an uncased well would allow contaminants that were at all upper levels to migrate to lower levels fairly quickly thus eliminating the usefulness of the samples at depth. Therefore using data from these wells to make determinations about the condition of the intermediate and deep aquifers would tend to make any conclusion suspect. There may have been safeguards in place to prevent this but it is not stated in the report nor am I aware of what may have been used to prevent this.

Response:

Each new monitoring well does contain a steel surface casing. The casing depths are 104 feet for MW-1, 146.5 feet for MW-2, and 132 feet for MW-3. During the Phase II RI investigation, the three new deep monitoring wells were designed to mimic the construction of other intermediate to deep wells at the site. Like other site intermediate and deep wells, the groundwater samples collected from the three new deep monitoring wells represent the total water column per well. Each new monitoring well's sample results, as found in the Phase II RI document, do contain valuable information and data regarding the uncased portion (water column) of each well, so the data is usable.

During the Post-Phase II RI investigation, MW-1 and MW-3 were completed with inner steel or PVC casing, so MW-1's inner PVC casing is 349 feet deep and MW-3's steel casing is 327 feet deep. MW-2 will be completed as part of the OU2 investigation. The two new shallow monitoring wells, MW-4 and MW-5, were constructed with a steel surface casing of 29 feet for MW-4, and 35.5 feet for MW-5. The PVC inner casings of the two new shallow monitoring wells are 160 feet for MW-4 and 178 feet for MW-5.

Packer tests were done on four of the new monitoring wells, MW-1, MW-3, MW-4, and MW-5. The depth that TCE and other COPCs were detected in the shallow part of MW-1 is the same depth as the packered zone in OGV01. The absence of TCE and other COPCs in the shallow part of MW3, the absence of TCE and other COPCs in shallow monitoring wells MW4 and MW5, is the same shallow (less than 450 feet deep) packered zone in OGV01, where small TCE concentrations were detected. The absence of TCE and other COPCs in nearby shallow monitoring wells and the large TCE concentrations detected at depth in OGV01 strongly suggests that the source of TCE and other COPCs in OGV01 and OGV02 are not from a local source.

Comment 55:

We would like to know how the cost estimates were determined. It is not clear from the report the specific methods to be used to achieve the desired result and without specific methods or the values applied, it is difficult to predict how reasonable those values are or if portions may be subject to volatility in price due to time (i.e., the price of asphalt is extremely high now due to unpredictable events that have occurred recently).

Response:

See response to Comment 46.

3.5 Past Comments From a PRP not Answered in Section 3.4

The following are the resubmitted questions from TRW regarding the Phase II Remedial Investigation (RI), the Phase II Feasibility Study (FS), the Human Health Risk Assessment (HHRA), the Ecological Risk Assessment (ERA), and the Phase II Proposed Plan. Since these questions are not related to OU1, the questions are presented here: however, TRW will need to resubmit the questions for response at the end of the Post-Phase II RI/FS for OU2. A copy of all TRW's comments and questions can be found as a separate document in the Administrative Record.

Comment 1:
The purported contaminant migration pathway in the RI between the alleged sources (closed Sullivan Landfill) and the alleged receptors (the OGV Wells and La Jolla Springs) is not technically or scientifically supported. Specifically, the RI completely fails to establish any hydrogeologic link, a chemical link, or a temporal link between the alleged sources and receptors.

Comment 2:
What changes to the RI would occur if the MDNR accepted rather than rejected the groundwater connections to the Rivers that are shown in Imes and Emmett (1994)?

Comment 3:
What is the DNR's basis for concluding that the OGV Wells capture COCs from the closed Sullivan Landfill (located approximately 5200 feet downgradient of the OGV Wells) when the zone of influence for the OGV Wells is only 1,000 feet?

Comment 4:
How does the DNR explain the lack of correlation between the substances and concentrations detected at the OGV Wells and at the closed Sullivan Landfill?

Comment 5:
How does the DNR explain that the chemical ratio of parent-to-daughter compounds (i.e. TCE-to-DCE) is higher at the OGV Wells than at the closed Sullivan Landfill? When it can be measured, the TCE/DCE is always less than 10 at the closed Sullivan Landfill. At OGV, TCE/DCE ranges from 17 to 30. This relationship is backwards from that which would be expected.

Comment 6:
How were materials in the Administrative Record relating to the alleged pathway from the closed Sullivan Landfill to the OGV Wells used to formulate and evaluate remedial alternatives for the Site?

Comment 7:
How does the DNR explain the absence of Freon-12 at the La Jolla Springs?

Comment 8:
How does impacted groundwater from closed Sullivan Landfill flow to both the OGV Wells and the La Jolla Spring when the two are in opposite directions?

Comment 9:
Where in the Administrative Record is there supporting documents for the conclusion that groundwater migrates from the closed Sullivan Landfill to the La Jolla Springs?

Comment 10:
Why is the city of Sullivan lagoon, immediately adjacent to the closed Sullivan Landfill, not investigated as a potential historic or continuing source?

Comment 11:
Where in the Administrative Record is there supporting documents for the conclusion that groundwater migrates from the closed Sullivan Landfill to the Highway AF Wells?

Comment 12:
What are the source(s) of contaminants found at the Highway AF Wells, particularly DBCP that are not allegedly from the closed Sullivan Landfill?

Comment 13:
How does the DNR explain the lack of correlation between the substances and concentrations detected at the closed Sullivan Landfill and the Highway AF Wells, particularly DBCP?

Comment 14:
Plume areas identified in the HHRA are named in such a way that suggests the sources are known. This is not the case. Naming the area that includes the Ramsey Site as the "TRW Plume" suggests that TRW is source of constituents for those wells included in the plume. The following issues should be addressed:

- Risks associated with private wells identified in the "Sullivan Landfill Plume" areas that are located northeast of the landfill and apparently upgradient are primarily represented by water quality in the Voss Well (GWS003). The Voss Well, which supplies a commercial facility, is located east of and adjacent to the landfill. Levels of constituents in the Voss Well should not be used to represent risks in the local private wells included in the closed Sullivan Landfill area. For example, the Voss Well is the only well in this area where vinyl chloride was detected and it was detected above the MCL. Private wells should be reevaluated and risks should be evaluated based on data collected in the wells and water quality that is expected to impact local groundwater in the future.

Comment 15:
Toxicity values should be consistently used based on the most appropriate values for the regulatory framework, route of exposure, receptor, and best science. The HHRA does not consistently use the latest values provided by USEPA (e.g., USEPA IRIS) and does not consistently use those values recommended in Missouri's latest guidance (e.g., MRBCA Technical Guidance [February 2005]). The assessment should be consistent with the most up-to-date values, and with the regulatory context. Please address the following specific comments:

- Potential inhalation exposure to TCE should be evaluated using toxicity values derived based on the inhalation study data. USEPA provides an inhalation slope factor (USEPA 2001) based on a study of workers exposed in workplace air. Risks associated with worker exposure to TCE in the La Jolla Cave air are provided as a range. At one end the estimated risks for workers inhaling cave air are acceptable, but at the more conservative end they are not. Unacceptable risks were calculated using a toxicity value provided in the draft USEPA Assessment (USEPA 2001) based on a drinking water study. However, USEPA also provides a toxicity value derived based on workers exposed to TCE through inhalation in the workplace in the same document (USEPA 2001). The value derived based on a human inhalation exposure is more appropriate. Changing these assumptions and parameters significantly reduces the estimated risk for cave workers. See the discussion provided in section 5.9.3.4.

- Updated assessments and toxicity values provided on the USEPA's Integrated Risk Information System should be used as available in the assessment. 1,1-DCE should not be evaluated as a carcinogen quantitatively in the HHRA. USEPA IRIS updated its cancer assessment for 1,1-DCE in 2002 (8/13/2002) and determined that data was not appropriate to support a quantitative assessment for cancer (http://www.epa.gov/iris/subst/0039.htm). Including 1,1-DCE in the evaluation as a carcinogen increases the estimate of lifetime cancer risk.

- Under the HHRA methodology, 1,1-DCE is a significant contributor of excess cancer risk in certain locations (e.g., see Table 11b and 9b). The HHRA uses an outdated inhalation slope factor provided in the 1997 version of HEAST (USEPA 1997). The current IRIS assessment supercedes the HEAST. The USEPA Regional screening levels (e.g., USEPA Region 3 RBCs 2004 and USEPA Region 9 PRGs 2004) do not include an evaluation cancer risk for 1,1-DCE. In addition, the Missouri (2005) RBCA guidance does not provide a cancer slope factor for 1,1-DCE, and recommends the use of toxicity values protective of noncancer effects (i.e., RfDo of 5.0×10^{-2} mg/kg-day and an RfDi of 5.7×10^{-2} mg/kg-day).

Comment 16:
The assumptions used in the HHRA lead to an overestimate of exposure and therefore risk. Exposure to constituents in tap water should be based on the best available data and information.

Exposure estimates must be based on a rigorous evaluation of the data and the strongest science possible. Please address the following specific comments:

- The concentrations of TCE in each of the exposure areas in the La Jolla Cave Complex air samples (Gift Shop, Cave Trail, and Ballroom) (maximum detected of 1,700 ug/m^3) were significantly higher than collected at any other time (2002, 2004 or 2005). The maximum concentrations in 2004 and 2005 were 16 ug/m^3 and 9.8 ug/m^3, respectively. The maximum detected in 2002, prior to 2003, was 100 ug/m^3. The concentrations over time are summarized on Figure 3 in the HHRA. It is important to understand whether the concentrations of TCE measured in the air in 2003 represent a short-term exposure to the higher concentrations. If the levels of TCE detected in 2003 actually represent a short-term exposure, using these levels in the HHRA to estimate long-term worker exposure significantly overestimates risk. Was the potential for sources of TCE other than groundwater evaluated? For example, there could have been activities in the cave in 2003 that contributed off-gassed TCE to the air such as remodeling (e.g., use of certain adhesives, painting or staining/varnishing, use of certain finished wood materials). Additional air data should be collected and the potential for other sources to have contributed TCE to the cave evaluated before selecting remedial actions.

- Samples collected from the Voss Well (GWS003) had the highest detections for most constituents of the wells tested in the so called "Sullivan Landfill" plume area (e.g., vinyl chloride, and 1,1-DCE). However, the maximum concentration of TCE was detected in PW-14. The maximum detected within the group of wells in this area was used to estimate risk for all the wells in this area. This approach does not use all the available data and should be refined.

Comment 17:

In some cases, changing the toxicity values to the most appropriate and refining the exposure assumptions changes the conclusion from conditions that are "not acceptable" to "acceptable." For example, refining the worker exposure assumptions (i.e. use of an 8-hour work day rather than the assumed 24-hour work day) and the toxicity values recommended by Missouri would change the conclusions regarding TCE in cave air from "not acceptable" to "acceptable" for some workers. In addition, if the TCE levels in the air reported in 2003 (see discussion in the previous section) were associated with a temporary source (e.g., product use, remodeling) and this calculation is completed using the maximum detected concentration of TCE between 2004 and 2005, estimated risks associated with inhalation of TCE in cave air fall into the acceptable range (10^{-4} to 10^{-6}) for all workers evaluated in the HHRA. Remedial decisions should be based on an updated analysis.

The estimated cancer risk for seasonal Gift Shop workers presented in the HHRA ranges from 2.29×10^{-4} to 3.41×10^{-6} based on the maximum (2003) and an average concentration in air, respectively (Table 12a). Adjusting for an 8-hour workday and using Missouri's recommended toxicity value or USEPA value based on inhalation the range changes 1.14×10^{-6} to 1.34×10^{-6} and 1.14×10^{-6} to 3.82×10^{-6}, respectively. The entire range is acceptable both within USEPA's framework and Missouri's target risk of 1×10^{-5}. If the risk is then calculated based on the maximum detected concentration in 2004 and 2005, the estimated cancer risk for seasonal Gift

Shop workers then ranges from $1.05x10^{-7}$ to $3.66x10^{-8}$ and estimated risks for all workers evaluated in the assessment fall into the acceptable range (10^{-4} to 10^{-6}).

Comment 18:
The RI presents data that does not appear to have been considered in the preparation of the HHRA. In some cases this contributes to an overestimate of risk and in some cases it may contribute to an underestimate of risk.

There are over twenty such inconsistencies between data in the RI and the HHRA. Three examples are:

1. DBCP was detected in the Voss Well in November 2004 above the MCL, but was not retained as a COC.
2. MIBK was detected in the Voss Well in May 2004 but was not listed as a COC.
3. Carbon tetrachloride was detected above the MCL of 5 ug/L in the Voss Well in April 2002. The maximum in the HHRA is lower than the MCL.

The HHRA fails to state why all the available data was not used. If data presented in the RI is not deemed appropriate for use in the risk assessment, the rationale for eliminating the data needs to be provided. Data consistency issues need to be resolved.

Comment 19:
Were sources of TCE other than impacted groundwater evaluated in the La Jolla Cave? How was this evaluated?

Comment 20:
Will concentrations of TCE used in the risk to the La Jolla cave continue to be based on the highest value measured?

Comment 21:
Can the DNR expand on whether any alternative corrective measures were eliminated based on the assumptions for groundwater removal at the closed Sullivan Landfill? Further, can the DNR provide any groundwater pumping data and modeling results that support or refute the flow volume assumption at the closed Sullivan Landfill?

Comment 22:
How are the site characterization data developed in the RI adequate to identify the nature and extent of contamination to support the contention that the TRW/Ramsey site is the primary source of contamination at the OGV Well Site?

Comment 23:
What is the basis for ignoring and/or dismissing other potential sources of contamination, including but not limited to septic systems, wastewater lagoons, and Meramec Industries?

Comment 24:
Why are various remediation timeframes not provided for the various alternatives considered as required by the 1988 RI/FS Guidance?

Comment 25:
What discount rate has been used for this analysis?

Comment 26:
What are the assumptions that allow the RI not to quantify potential sources of contaminants for the site?

Comment 27:
The FS does not include the alternative proposed for implementation in the Proposed Plan. Why does the Proposed Plan contain an alternative not evaluated in the FS when the two documents were evidently completed and made available in the same time frame?